The Dock & Harbour Authority

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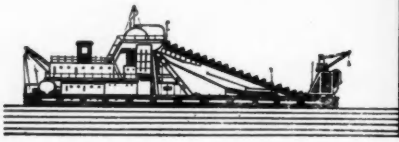

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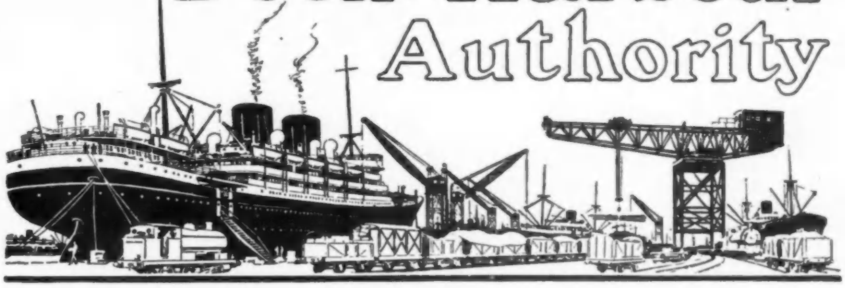

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The Dock & Harbour Authority

An International Journal with a circulation extending to 85 Maritime Countries

No. 471

Vol. XL

JANUARY, 1960

Monthly 2s. 6d.

Editorial Notes

The Port of Tema

The construction of the new Port of Tema, the subject of a special article in our pages this month, is an outstanding example of the political and economic changes following the Second World War and, in particular, those resulting from the independence of "colonial" territories. The origins of this port in the recently established State of Ghana were to some extent bound up with the earlier history of the great Volta River Project and certain preliminary economic studies demonstrated its necessity nearly ten years ago.

The development of Ghana in modern times has probably been hampered more by broad climatic and health factors and by restricted internal communications than by lack of deepwater seaports. Nevertheless it is indicative of the economic potential of the country that the first seaport, Takoradi, was opened about 30 years ago and within ten years had become inadequate. The shortage of deepwater facilities has been and is still being made good, albeit at a very high price, by the surf ports. At Accra, in particular, remarkable tonnages—up to 50,000 tons per month—have been handled by hand propelled surf boats under the most primitive conditions. These arrangements, though deserving of praise as examples of skill and ingenuity, also well illustrate the tendency for the communications system to lag behind the demands of the traffic. With the coming into full use of eight berths for general cargo at Tema in 1962 however, this weakness will be largely remedied.

The coastline of Ghana provides no natural deepwater harbour sites. The many inshore lagoons are too shallow for development, while the bays and promontories are too small to provide even rudimentary protection. The mouth of the only considerable river, the Volta, has a complicated and shifting bar regime which led to the abandonment of earlier proposals to site a harbour for the aluminium traffic there. An artificial harbour having been accepted as inevitable, it was preferable for it to be as near as possible to Accra as representing the administrative capital and an established centre for seaborne trade. A series of investigations was therefore instituted to determine the best site.

Although harbour engineering is perhaps unlikely ever to be an exact science the hydraulic and structural aspects at least, are becoming more and more amenable to mathematical and experimental techniques. When sufficient time and money can be allocated hydraulic model experiments can clearly establish the relative merits of alternative breakwater layouts, entrance arrangements, basin dispositions etc. In the case of Tema, the Hydraulics Research Station, at Wallingford, carried out a thorough series of investigations which amply justified themselves even on the narrowest financial interpretation.

The chosen layout of quays, sheds, storage areas, roadways, railways etc. is likely to be the subject of much discussion. The arrangements were clearly influenced by the concept of the "railway port" since in Takoradi some 60% of cargo, in and out, is still rail-hauled. Although at Tema road traffic has evidently been carefully considered it will be of interest to observe the haulage pattern in the future. Many harbour engineers and managements would anticipate that in a rapidly expanding country like Ghana, where the railway system is not specially linked to a particular bulk traffic, the rail/road traffic ratio may fall almost proportionately with the rise and development of total trade. Such a situation, in say fifteen years time, would call for extensive parking areas, stringent traffic segregation and elaborate control over vehicle movements as well as generous provision of loading bays etc. The provisions made at Tema to anticipate this situation may yet prove to be by no means excessive.

The Port of Tema represents, for the moment, the most important development project under construction in the new state of Ghana and there is no doubt that it will make a significant contribution to the development of the country.

British Inland Waterways

Public attention has again been focussed upon the canals and other navigable waterways in Great Britain, in consequence of a recent Private Member's motion in the House of Commons. It will be remembered that the Bowes Committee submitted their report in June 1958—a report which, like many others preceding it, represents the considered judgment of an eminent panel after very full study. The report unanimously advocated several new proposals for resuscitating traffic along certain routes and for "re-developing" unwanted canals; the waterways were categorised according to their recommended treatment. Amongst the constructive proposals for waterways with traffic potential were, re-instatement to full working order, a guarantee of their continued maintenance in order to provide security to users, substitution of annual boat licences for the present tolls and a subsidy from public funds to meet the deficit.

The Government could not accept the proposals in full, indicating that one reason for their decision was the disagreement within the Committee as to the body to administer the Waterways. Instead, the White Paper of February 1959 established a further Advisory Committee—the Parham Committee—primarily to investigate and initiate plans for "redevelopment" of canals no longer of commercial value.

The disagreement within the Bowes Committee concerned the question whether the waterways should remain with the British Transport Commission or whether they should be transferred to a new Corporation. During the parliamentary debate on their report, a further scheme emerged, described as a compromise, that a new Conservancy should be established; this would draw some revenue from public subscriptions and appeals and would differ mainly in this respect, but, also, the emphasis on transport would apparently be diminished. Arguments in support of this

scheme were often coupled with generalised claims in favour of the inherent economy of water transport—a thesis long since disproved. Many of these speakers admitted that they advocated identical views because they were using the same brief, a fact which does not encourage confidence in the validity of the arguments. The Government spokesman skilfully expressed interested sympathy but declined to be drawn into a commitment for Treasury support. Although those now responsible for these waterways will be grateful for the Government assurance that they do not suffer from any railway background, they deserve sympathy in their predicament, which springs from the absence of any clear long-term policy.

The Inland Waterways Conservancy proposed during this debate is described as a cross between the Thames Conservancy and the National Trust. The Thames Conservancy, however, has peculiar features in that it derives a large revenue from the sale of water for London and has other assured income from rates; it is hardly the pattern for a National body. It seems that finance would be required from central funds to an extent exceeding a million pounds annually. Since the most heavily used navigations, serving ports, are today barely self-supporting, the question must be asked whether such public expenditure is justified, when it is largely, it might be said, for the benefit of a small sectional interest of pleasure-boat users.

On the other hand, many waterways are now subsidised from other transport revenue and, if Government financial relief and security for the waterways can only be forthcoming if accompanied by this suggested method of re-organisation, this might be acceptable.

Such a change could dispose of another doubt about the future of inland water transport, with its influence upon port operation. Although the present direction of British Waterways warrants no complaint from the commercial users, the waterways remain as a junior partner to British Railways. When the railway modernisation plan is completed, the Commission is committed to ensure that railways are profitable. The suspicion is not wholly unreasonable that, under changed conditions, the interests of inland waterways might be sacrificed.

Whatever decision is to be reached, delay must be short and it is essential that the interests of inland water transport are properly safeguarded. This could be done, with appropriate guarantees, either within the framework of a national transport organisation or by means of a separate Corporation, responsible to the Minister of Transport. It is the establishment of security which is the important factor.

The Simplification of Documentation

During recent years much effort has been directed to decreasing the amount of time ships spend in port discharging and loading. Cargo handling methods, gear and equipment, hold stowages, the condition and packs of cargo, ships' derricks, hold design, port premises and shore cranes have all been subjected to attention, important improvements having resulted in each sphere. Progress of this kind has been made easier because, although all these factors in port working are closely linked, each could be dealt with separately by individuals or organisations who were in a position to take effective action.

One sphere in which insufficient progress has been made however, is that of documentation. As stated in an article on the simplification of shipping documents which appeared in our December issue, there is nowadays a mass of official paper work involved in the port to port movement of a ship. This seems to have grown in volume over the years, if not unnoticed, at least unchallenged, until the time has been reached when the quantity and diversity of documents required by custom and practice can delay the loading and discharging of a ship and also seriously increase the dock turnround time of land transport vehicles.

Dock offices often cannot cope with the volume of documents tendered to them on a busy day, one reason being that forms (e.g. shipping notes) although having the same purpose, vary greatly in size, shape and colour, besides having been printed without any attempt at standardisation. Goods can arrive at a certain point in their journey and then stop moving, also because the relative documents, although often not essential ones, are missing, incomplete or inaccurate and this, too, can result in shed congestion, double handling, lost journeys, discontented labour, the shutting out of export cargo and inability to deliver import cargo.

The difference between the documents factor and the other factors already mentioned (premises, equipment, handling methods etc.) is not only that so many varied interests are concerned with documents, but that many of them are not readily accessible or are transitory.

As is well known, enormous difficulties are created intermittently in the docks because at too many berths 60% or more of the total export cargo is tendered on the last day or two the ship is loading. Early in the receiving period only a few consignments arrive but as the vessel is closing, there are so many lorries in the rank that no organisation and no pre-planning could possibly deal with the situation satisfactory. Even if, as the result of superhuman effort, vans are not turned away, it is inevitable that many of them must wait hours to be unloaded. Port Authorities and other employers of labour have, for many years, pressed shipping companies to try to remedy this situation, in most cases with little or no success—the main reason being that there is no control over the actions of the exporter or his cartage contractor and little co-operation from either.

The lack of standardisation of shipping documents only adds to the chaos at such times of pressure. What is required is not only standardised forms but fewer of them—and this is not an academic requirement, it is an urgent practical need, the meeting of which would bring useful, visible results. The shipping company, the labour contractor, the exporter and his cartage contractor would be among those benefiting and it is no guess to say that each interest would then wonder why simplification had not been undertaken years earlier.

A further article and correspondence on this question appear on following pages in this issue. In dealing with "The problem of documentation," the author of the article mentions that much attention has already been paid to this matter by such bodies as the I.L.O., the I.C.C., P.I.A.N.C., I.C.H.C.A. and the O.E.E.C., all of which have done great service in attempting to provide the public they reach with an understanding of the steady loss to which the industry has for too long tamely submitted. He goes on to state what is obviously not only true but urgent, viz. that certain documents should be abolished as obsolete or unnecessary and that, with those remaining in use, there must be rationalisation and standardisation. This has long been recognised, however, and the fundamental issue is how these desired improvements shall be achieved.

It is encouraging that several countries are now investigating this complex problem. In particular, Scandinavian shipping lines are seeing that important advantages may be gained by using a smaller variety of simpler documents; one of them has introduced standardised bills of lading. In the international sphere, as stated in these columns last month, a sub-committee of the International Chamber of Shipping has been formed to study the subject and recommend what action shall be taken. This sub-committee suggests there is "an urgent need for a review nationally of the requirements of different countries." This is a good starting point but many port officials feel that something more positive should be done and the immediate need is to find an influential organisation to take the initiative on their behalf.

The Port of Tema

New Harbour for Economic Development of Ghana

(Specially Contributed)

During the recent visit to Ghana of His Royal Highness the Duke of Edinburgh, much emphasis was placed on the great economic and industrial expansion which is now taking place in this new state, which had barely celebrated its second anniversary of Independence. At a special exhibition held at Accra to mark the beginning of the second five-year development plan, the Duke saw models of many projects which are under construction or proposed. Among these was a model of the Port of Tema, on which were shown the various works now nearing completion, and the several further extensions and developments under consideration.

On the 25th November, the Duke was the guest of the Prime Minister, Dr. Kwame Nkrumah on a visit to the new Port and town of Tema, the quarry works in the Shai Hills, and to the imposing new Volta Bridge which crosses the river at Adomi, as well as the sites of various preliminary works connected with the Volta River Project.

An essential requirement for this project was a new deep-water port at some convenient point on the coast of Ghana. This port would have the function of receiving the great quantities of plant and materials to be imported for constructing and operating the project and of exporting the finished aluminium, since the only existing deep-water port, Takoradi, was too far from the dam and smelter sites. The Consulting Engineers, Sir William Halcrow & Partners in their Preliminary Report of 1951, advised against an earlier proposal to site this new port at the mouth of the River Volta for several technical reasons connected with construction and navigation. They further advised the then Gold Coast Government that, quite apart from the requirements of the Volta River Project, a new general purpose deep-water port was urgently needed to handle the growing trade of the country which was rapidly overtaking the capacity of Takoradi, and the various surf ports. It was concluded that this new harbour should be located and designed to meet the requirements of general trade and of the Volta River Project. Several sites were examined in detail, and that finally chosen for the harbour was at Tema, some seventeen miles east of Accra, the capital.

The Government lost no time in implementing these recommendations, and in 1952 a start was made on the construction of preliminary works.

Preliminary works

In order to facilitate the main harbour construction, it was decided to go ahead as quickly as possible with the construction of access roads and railways; provision of water and electricity supplies; a hospital, and the building of houses both in Accra and at Tema for the labour force. These works were carried out between 1952 and 1954 at a cost of more than £3,000,000.

The site of the new port was connected with the existing road and rail system by the construction of eighteen miles of 3-ft. 6-in. gauge railway, together with eight miles of trunk road and as much again of access road. These works were carried out by Taylor Woodrow (West Africa) Ltd., under the direction of the Consulting Engineers. Further, in order to provide access to the quarries, from which some 5 million cubic yards of rock have since been won, a further twenty miles of railway was constructed northwards from Tema to the Shai Hills, and a six mile length of trunk road was built to connect with the existing road system. Both road and railway form part of the extension of communications from Accra and Tema to the site of the Volta River works.

The construction of the Shai Hills railway and ancillary works was undertaken by George Wimpey & Co. Ltd., and this same contractor also installed the water supply system, which involved laying over forty miles of pipe-line to link the harbour and quarry with the Accra mains system. Four pumping stations have been constructed, and two reinforced concrete reservoirs provide storage capacities of 300,000 and 750,000 gallons.

General view of harbour showing completed Quay No. 2.

These preliminary works, although forming only a small part of the harbour project, were nevertheless major engineering works in themselves, requiring the construction of eight road and rail bridges and some ninety culverts. The outstanding feature of these contracts was that, for the first time on West African railworks, a fleet of modern 20 cubic yard rubber-tyred tractor-scraper units was employed, which, in the hands of their African drivers moved over $1\frac{1}{2}$ million cubic yards of earth. Some 2,500 men were employed on the works, and formed

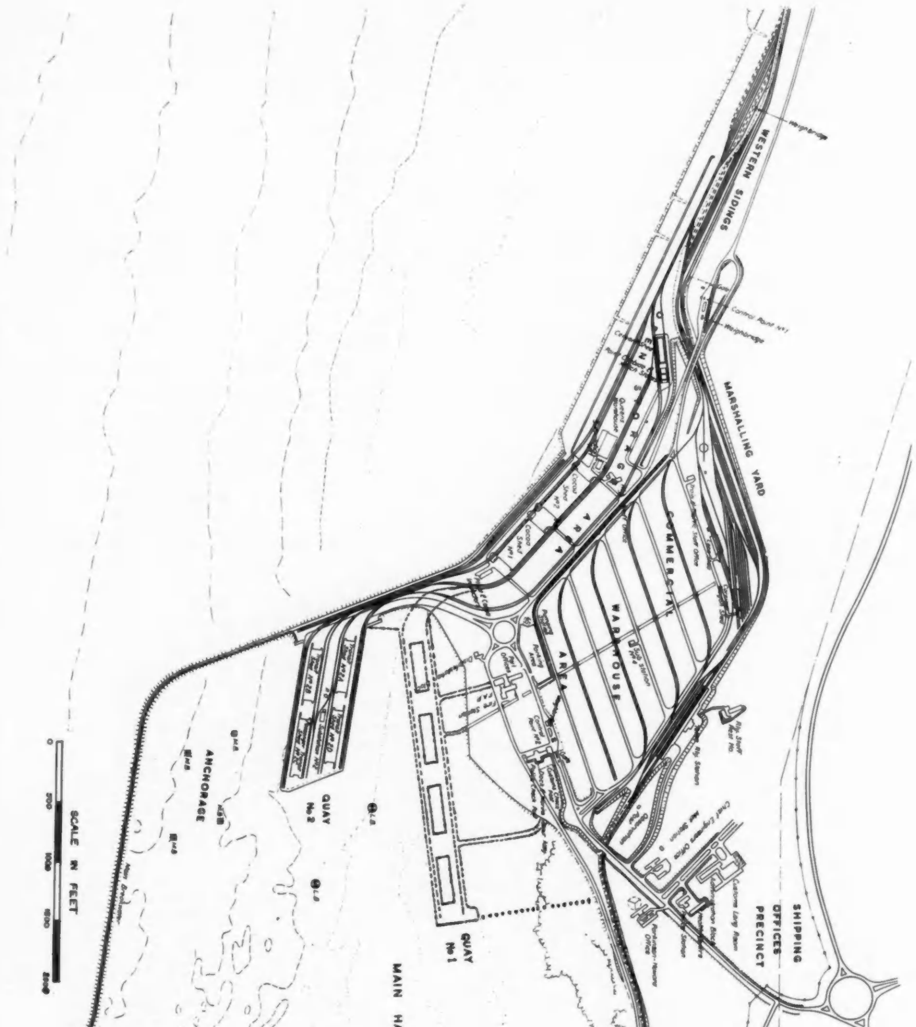


Fig. 1. Plan of the Port of Tema.

a valuable nucleus around which was built the labour force for the harbour construction. These works ensured that there would be adequate and direct communication between the new harbour and the existing communications network.

In September 1954, the contract for the construction of the harbour was awarded to Parkinson Howard Ltd., a company formed in association with the two British firms of Sir Lindsay Parkinson & Co. Ltd., and John Howard & Co. Ltd. This firm was also awarded a second contract for the construction of a diesel-engine power station, with an initial capacity of three 650 KW sets, which was completed in 1956.

General Description of the Harbour

The general layout of the port is shown in the plan (fig. 1). The first stage of the harbour construction works which provides four deep-water berths, is now approaching completion. Second and future stages envisage eight and (eventually) twenty deep-water berths, traffic for the Volta River Project being accommodated at each stage as necessary.

The water area of the harbour is about 500 acres, protected by two rock rubble breakwaters; the main and lee breakwaters being respectively 7,200 and 4,800-ft. long, and providing an entrance width of 800-ft. in a minimum of 36-ft. depth of water. The quay built in the present first stage of development is 1,200-ft. long and 490-ft. wide, providing two berths on the inner side with alongside minimum water depth of 26-ft. and two berths on the outer side with a depth of 30-ft. Three single-storey transit sheds have been constructed and a fourth, at the mailboat berth, has an upper floor which will provide special accommodation for passengers, dutiable goods and offices. Some three acres of open storage space is available down the centre of the quay for "rough" cargo. A dockyard with small dry dock and slipways, fitting-out quay, and workshops is under construction on reclaimed land inside the lee breakwater. Outside the lee breakwater a fishing harbour has been built providing 20 acres of protected water, 1,000-ft. of quay with a minimum of 12-ft. water alongside, and a boat building yard.

Towards the end of the lee breakwater, an oil berth is now under construction, providing accommodation for tankers up to 35,000-tons dwt.

Extensive shore works now nearing completion cover an area of about 250 acres, and comprise railway sidings and marshalling yards, access roads, covered and open storage areas, parking spaces and a large area laid out for commercial warehousing. A full range of harbour buildings for fire, police, customs, health services, etc., is being built, including a main multi-storey block for railway and port administration

departments. A 100-ft. reinforced concrete lighthouse has been completed on high ground close to the harbour, equipped with the latest type of electric automatic light with 20 mile visibility.

During the course of the design of the harbour, it was decided to carry out an extensive programme of experiments on hydraulic models. This was undertaken by the Hydraulics Research Station, Wallingford, for the Consulting Engineers, to determine the best design for the breakwaters and to confirm the suitability of the general layout of the harbour. This work continued between 1954 and 1957 and provided invaluable information which led to modifications which have been incorporated in the final design of the harbour.

The Quarries

One of the first jobs which the Contractor had to takle was the opening-up of the quarries in the Shai Hills. The first, opened at Tetedwa, produced some 650,000-cu. yds. of gneiss rock but was eventually closed down as unsuitable for development. The second, at Mampong, came into operation later, during 1956 and to date has produced 4,330,000-cu. yds. of rock in sizes up to 10-tons. Both quarries were originally opened and worked on benching systems, using "Quarrymaster" and "Drillmaster" equipment. Later production however, was largely by means of heading blasts, which method was found to be more successful. During times of maximum production up to 200,000 cu. yds. of rock was obtained from a single blast.

The rock was loaded into trays and cobbles carried on 35-ton flat rail wagons in trains drawn by 750-h.p. diesel-electric locomotives to the harbour site.

The selected rock for filling behind the quay walls was mainly produced at the Tetedwa quarry and was transported to Tema by road.

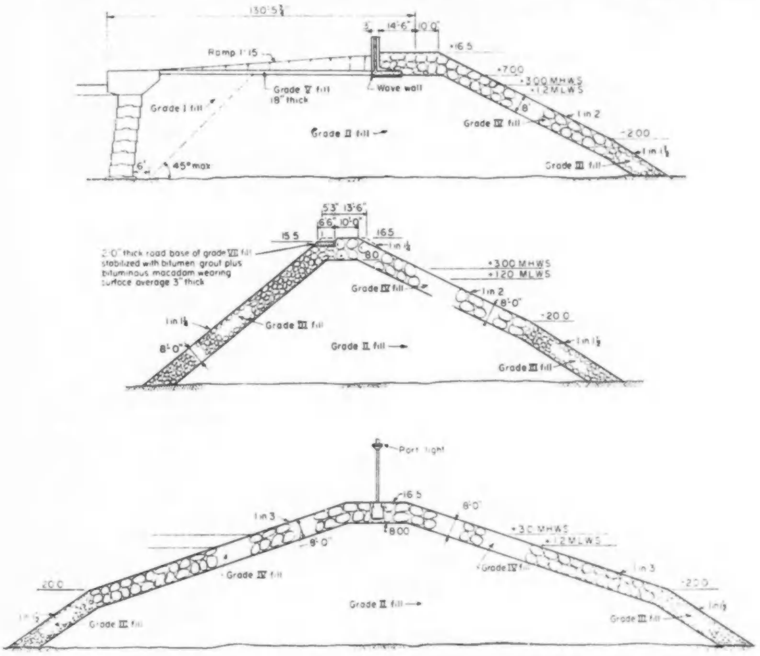
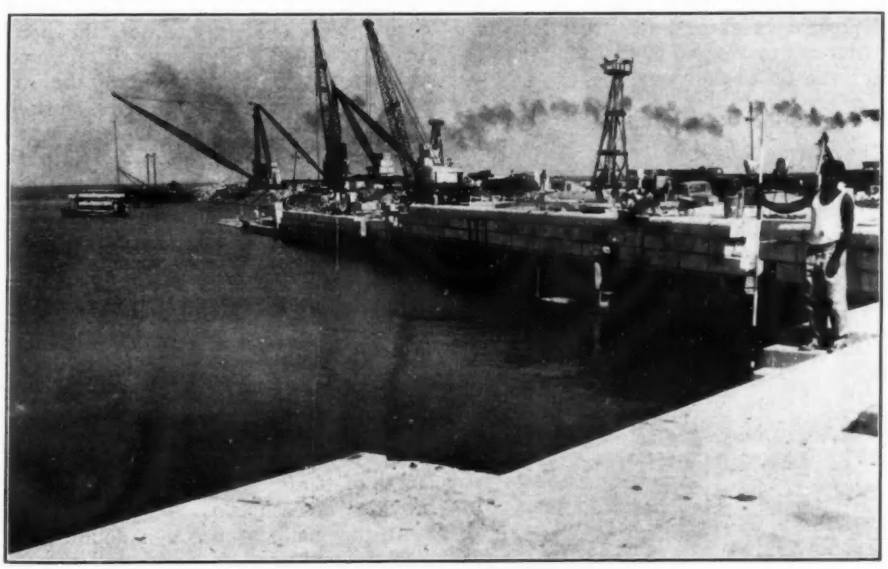


Fig. 2. Several variations in cross-section of the main breakwater.

Main breakwater under construction.



Quay No. 2 under construction.

Stone for concrete aggregates was hauled from the quarries to Tema partly by road, but mainly in side-tipping rail wagons to the central concrete plant near the root of the Lee Breakwater. These wagons tipped directly into a hopper feeding the crushers. A series of conveyors and vibrating screens separated the crushed rock into the various sizes and grades required and a derrick was then used to feed the hoppers of the concrete batching plant, from the various stockpiles.

Much of the road base material consists of quartzite rubble which is obtained from a third quarry at Afienya, some thirteen miles North of Tema. This material is also used to surface many of the parking and storage spaces.

Breakwater Construction

Typical cross-sections of the breakwaters are shown in fig. 2.

The breakwaters are constructed wholly of tipped rock, consisting of a core of

" quarry-run " material protected on both sides by a layer of selected armour stone, that on the seaward side being an eight-feet thick layer of blocks from 5 to 10-tons in weight The inner faces of the breakwaters are trimmed to a slope of 1 in $1\frac{1}{4}$. The outer faces of the main breakwater, and the lee breakwater (where exposed) vary from a slope of 1 in $1\frac{1}{2}$ at sea bed level to 1 in 2 above a point some 20-ft. below water. The breakwaters were designed with a top width of 16-ft. and 20-ft. respectively at a height (generally) of 13-ft. above high water level. This section was evolved by a modification of the original contract section, following two-dimensional model flume experiments at the Hydraulics Research Station. The Contractor, however, in order to provide a working space sufficient for a Lima 2,400 mobile crane, eventually formed the upper section of the main breakwater to give a top width of approximately 30-ft. From September 1958, the rock placing on the lee breakwater was also eventually done by a second Lima crane and it, too, has a top width generally of about 30-ft.

After reaching the harbour site from the quarries, the flat wagons carrying the trays of rock were pushed out to the breakwaters by diesel shunting locomotives. On arrival at the scar end of the breakwater, the trays were shackled to a cradle suspended from the 120-ft. jib of the Lima crane. The rock was then quickly and accurately tipped into position and the trays returned to the wagons. The placing of rock in the core of the breakwater in this way was augmented by the use of barges. The rail wagons were shunted within reach of 20-ton derricks which off-loaded the trays into hopper barges. These were then towed out to the line of the breakwater, where the rock was deposited through bottom doors.

Rock placing on the south and east breakwaters of the fishing harbour was carried out by two P. & H. 1055 cranes.

The overall rate of rock placing on the main breakwater alone was generally about 17,500-cu. yds. weekly. A ceremony held at the end of November, 1959, marked the completion of this breakwater when the last of 1,620,000-cu. yds. of rock was placed in position by the Lima, with Mr. Krobo Edusei the Minister of Transport and Communications at the controls.

A mass concrete wavewall runs from the root of the main breakwater a distance of 2,200-ft. out to the position of the finger quay. This wall was cast in-situ within specially constructed steel forms, and will prevent breaking water from reaching the four rail tracks and 60-ft. wide roadway which run on to the quay.

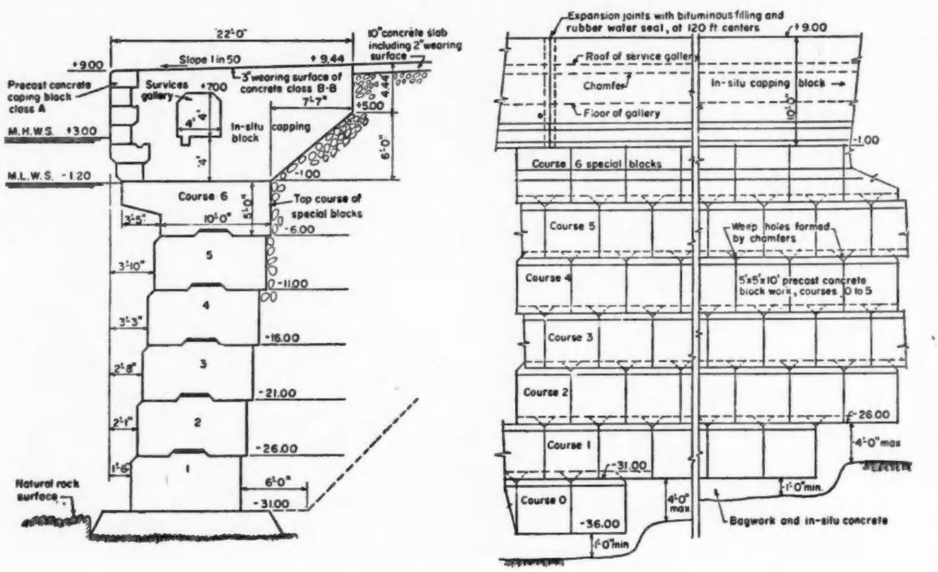


Fig. 3. Typical cross-section and elevation of the wall for No. 2 Quay.

The Finger Quay (No. 2)

The finger quay or " No. 2 Quay ", which has been built out into the harbour from the main breakwater, is now virtually complete. The main filling of the quay and approach arm has involved placing over 1,000,000-cu. yds. of quarry-run rock in the harbour, and this is enclosed by 3,250-ft. of quay wall. The quay wall is of unusual design, constructed mainly of precast concrete blocks 5-ft. x 5-ft. x 10-ft. long, which are placed below water in a bonded formation up to seven courses high and 10-ft. thick. A typical cross section is shown in fig. 3.

The first stage in construction was to break up and dredge the upper layer of rock forming the sea-bed. The foundation was then prepared by a team of divers, who then constructed two " shutter-walls " on either side of the foundation, using concrete bagwork topped by steel sections. The area between these walls was filled with concrete (placed in situ below water), the top of which was carefully screeded off to give a smooth level surface. The main blocks, which each weigh 16-tons in air were then placed on this foundation and built up in courses, the outside face of each course being slightly stepped-back from the lower course. Block placing was done by 20-ton derricks operating from the previously placed rock fill; the rate of placing was up to 125 per week. The last block was placed in position on the 27th September 1958, by the Prime Minister, Dr. Nkrumah.

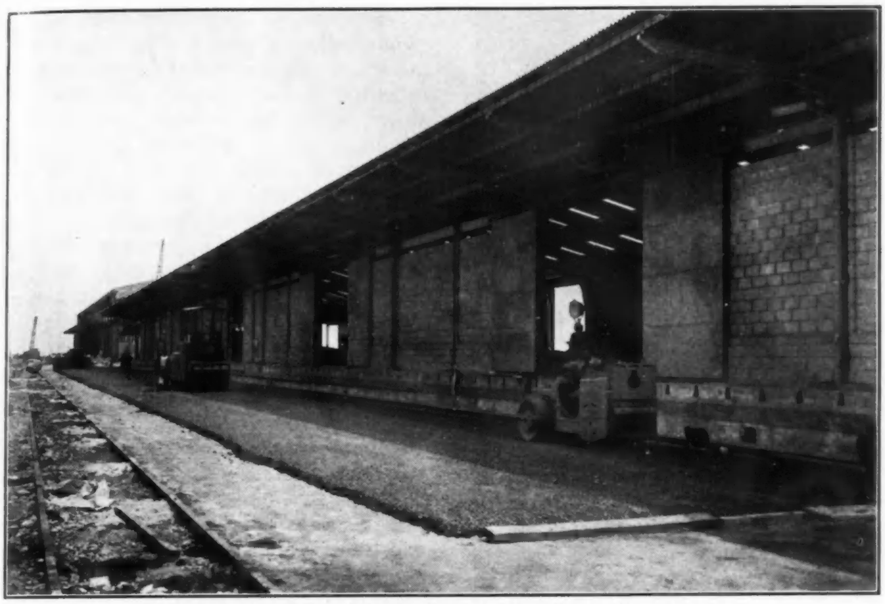
The "wedge" of selected rock fill between the back of the wall and the natural sloping face of the quarry run rock was brought in by lorry and tipped behind the wall as the courses were placed.

The top of the quay wall is formed by a capping block of mass concrete, 22-ft. wide and 10-ft. deep. This block contains a gallery 4-ft. high and 4-ft. wide in which run all the quayside services of fresh water, mains, electricity, telephone cables and sewers.

On top of the capping block runs the track for the quay cranes, and between these rails runs one of the two rail tracks serving the quayside. Provision has been made for a third rail track on each side should the need arise. The initial provision for cargo handling will be by means of seven 3-ton and four 5-ton capacity electric quayside cranes. These have been manufactured by Messrs. Stothert & Pitt Ltd., of Bath, and erection is due to commence shortly.

The transit sheds are set back some 70-ft. from the face of the quay, and in conformity with modern practice, the apron area is provided with a smooth reinforced concrete pavement to facilitate the running of mobile cranes, lorries, fork-lift trucks and other mobile cargo-handling equipment, along the quay and into the sheds. At three of the berths, the construction of the single-storey transit sheds has has been completed. The structure of these sheds consists of all-welded steel portal frames of 85-ft. span, supporting aluminium roof cladding with translucent rooflights. This form of construction provides the unobstructed working area of ample height which is needed to utilise to the best advantage the modern stacking trucks etc. which will be used at Tema. Each shed has a rail platform for its whole length of 460-ft., and lorry-loading bays are provided at each end.

At the mailboat berth, a double-storey steel framed shed is under construction. This shed is 500-ft. in length and, in addi-



Laying road surface alongside Transit Shed 2B on Quay No. 2.

tion to normal cargo storage on the ground floor, the upper floor is to be equipped with passenger accommodation, customs and other offices, baggage inspection rooms, and high duty stores.

Four lifts are provided to connect the ground and first floors. This shed contains, in all, some 800-ton of steelwork; the supply and fabrication of the sheds was undertaken by Wright Anderson Ltd., of Gateshead.

The central area of the quay, between the transit sheds, consisting of a bituminous surfacing, provides a large standing area for open storage of rough cargo.

Works on Shore

On the mainland, all the earthworks are now virtually completed. This has involved the excavation, transport and tipping of two and a half million cubic yards of earth and rock, generally by means of $2\frac{1}{2}$-cu. yd. excavators loading into trucks of 16-tons capacity.

The main export commodity of Ghana being cocoa, two very large sheds have been constructed in the harbour area for the storage of this product. These again are of all-welded steel portal frame construction with aluminium roofs and blockwork walls. Each shed has a single span of 170-ft. and is 440-ft. long. These are believed to be the biggest sheds of their kind yet constructed. Full rail access is provided along both sides of the sheds, and lorry-loading platforms are constructed at each end. Other smaller similar buildings provide accommodation for warehousing, cement storage, locomotive and wagon workshops.

Large areas have been cleared and levelled for open storage and extensive railway sidings and marshalling yards are presently being laid out.

Work is well advanced on the construction of the numerous office blocks for the port administrative and operating staffs. Generally, the main structures of these buildings are of reinforced concrete, supported where necessary on piles of local timber. To the north of the site, a modern new railway station is being built to serve the port and the new town of Tema.

At the present time, much of the heavy construction is concentrated in the north-east corner of the harbour where the completion of the dockyard is proceeding. The area has been enclosed by a rock-fill protective bund and the filling of soft material is largely completed. The contractor is presently constructing the small dry dock within a series of short cofferdams of steel sheet piling.

The fishing harbour quay wall is complete and the foundations of the 600-ft. long fitting out quay are now being prepared and are receiving the last of the six thousand pre-cast concrete blocks which have been produced in the blockyard in the past four years.

The Commercial Warehouse Area

Situated outside the Security (or Customs) Area, and immediately adjacent to it, is the Commercial Warehouse Area. This extends over some 60 acres and is divided into individual plots for leasing to private commercial interests. Each plot has full rail and road access, with direct rail connections to the nearby marshalling and sorting sidings connected with the berths and the main line. The main line provides a direct connection both to the industrial area of the new town about two miles to the north-east and, via Accra, to the north of the country.

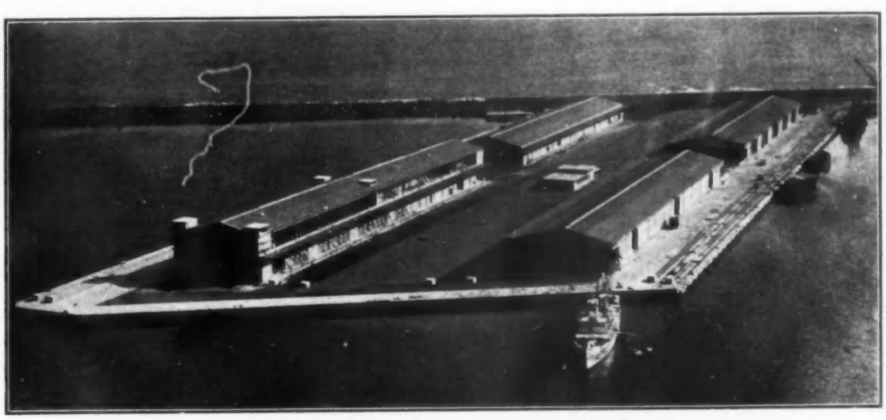
An extensive road system within the Commercial Warehouse Area is connected with the main harbour approach roads from the north and the west, and thus provides easy access for road transport to and from the new town and Accra, and to the quays.

The development of this area has required in addition to road and rail access, the provision of electric street lighting, electricity and water supply, surface water and foulwater drainage, and the installation of telephone communications. It is anticipated that with the next two or three years most firms established in the area will be provided with adequate warehousing facilities.

Second Stage Development

The total cost of the main harbour works of the 1st stage is about £13 million, and before the existing berths have been brought into commercial operation, the Government of Ghana have decided to proceed with the second stage of development of the harbour, following upon reports submitted by Sir Eric Millbourn, C.M.G. and the Consulting Engineers last June.

This development will take the form of a further four berths on a "marginal" quay



Work nearing completion on Quay No. 2.

Interior view of Cocoa Shed No. 2 under construction.

alignment, (No. 1 Quay) about 350-ft. shorewards of the existing No. 2 Quay together with a lighter berth 350-ft. in length. The proposals are for a concrete blockwork quay wall, 3,100-ft. long, four transit sheds 400-ft. long and 120-ft. span, open storage areas, and an extension of the rail and road system with the harbour. In addition it is proposed to construct an overhead conveyor from the two cocoa sheds to the first two berths on No. 1 Quay for the complete mechanised handling of the bagged cocoa from storage to ships hold.

Preliminary work for this extension is already being carried out by the contractors.

The construction of No. 1 quay will also entail the dredging of some 400,000-cu.-yds. of material from the sea bed, mostly rock. Tenders for this contract have been received and it is expected that dredging will commence early in 1960.

In addition to the general cargo berths proposed under Stage II of the development, it is anticipated that within the near future, an additional berth will be provided to cater for the specialised bulk handling requirements of cement clinker and other materials. This proposal follows from the intention of a commercial concern to construct, within the harbour area, a cement grinding works. In recent years, cement has formed almost one third of the total imports to Ghana, in order to cater for the immense building developments now being carried out, and it is expected that the provision of a clinker grinding works will more effectively satisfy this great demand.

It is intended to site this berth on the lee breakwater adjoining the oil berth.

It is also anticipated that this berth will import, in the early stages, much of the materials required for the production of aluminium at the smelter plant, which it is proposed to build near Tema.

The cement clinker, petroleum coke, etc. will be unloaded by "Kangaroo" cranes and transported to the shore by a conveyor along the lee breakwater.

Tema New Town

The construction of the extensive new town of Tema, just north of the harbour, is proceeding rapidly under the auspices of the Tema Development Corporation. The town provides houses, flats, shops, community centres and industrial areas in the most modern form for a new population which is already growing fast and it is estimated will reach about 50,000 within the next twenty years. Although many industries will no doubt grow up at Tema in the course of time it is likely that its paramount importance will remain as a port.

Elastic Dolphins of Uniform Strength

By F. VASCO COSTA, Civil Engineer, Lisbon.

Considerable savings can usually be made in any kind of beam by adjusting the cross sections to the bending moments. In the case of cantilevers working as elastic dolphins, the savings can be doubly important, because the adjustment of the cross material but also greater deflections, and, therefore, the possibility of absorbing greater amounts of energy. This means (though this is not generally realised), that an elastic dolphin composed of piles with a cross section which decreases towards the top will not only weigh less but will absorb a greater amount of energy than a dolphin composed of piles with a cross section that remains constant from bottom to top. Elastic dolphins of uniform strength do, moreover, offer the further advantage that, for a given amount of impact energy, the reaction they exert upon the ship is smaller than it would be in the case of elastic dolphins with a constant cross section.

In the impact of a ship against an elastic dolphin the kinetic energy is absorbed by the strain energy of the deflection of the dolphin. Denoting by f the deflection of the dolphin, by R its reaction upon the ship, by m the mass of the ship and v its velocity as it hits the dolphin, we can write:

$$n \frac{m\,v^2}{2} = R\,\frac{f}{2} \qquad (1)$$

In this expression n is a coefficient which takes care of the amount of energy consumed in friction. local deformation of the fenders, dislocation of water under the ship, and other forms of dissipation of energy. Depending on the type of ship, it is generally accepted that n=0.2 to n=0.5 (Minikin, 1950, p. 168 and 190).

For the purpose of this brief study it can be considered that elastic dolphins behave as cantilever beams, built in at the bed of the berth. In reality, point of fixity is some small distance below the bed level.

The total elastic strain energy that can be stored in a beam subject to bending can be evaluated (fig. 1) by

$$U = \int \frac{M^2}{2EI}\,dx \qquad (2)$$

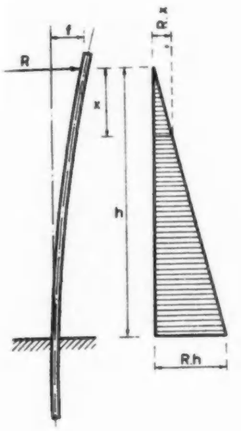
In the case of a cantilever beam of uniform section, I is constant, and equation (2) can be written:

$$U = \int \frac{R^2x^2}{2EI}\,dx = \frac{R^2h^3}{6EI} \qquad (3)$$

In the case of a cantilever beam of moment of inertia proportional to the bending moment the curvature will be constant; Whence

$$U = \int \frac{MRx}{2EI}\,dx = \frac{MRh^2}{4EI} = \frac{R^2h^3}{4EI} \qquad (4)$$

where I denotes the moment of inertia at the built-in section of the beam.



Section B.M. Diagram

Fig. 1.

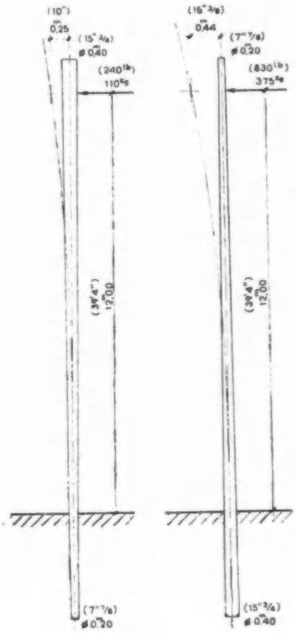


Fig. 2.

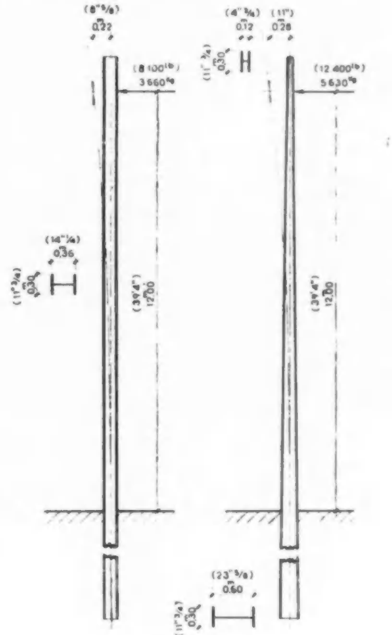


Fig. 3.

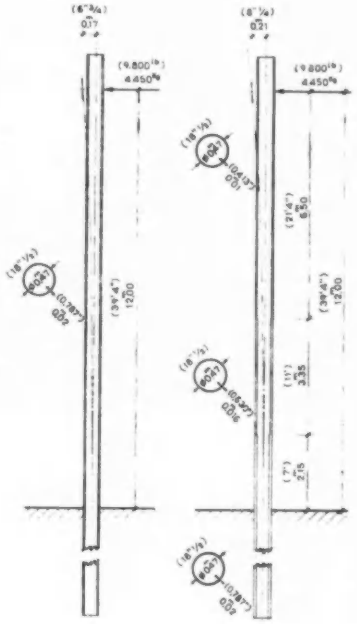


Fig. 4.

If we compare eq. (3) and (4) we see that a cantilever whose moment of inertia is proportional to the bending moment absorbs 50% more energy than does a similar cantilever of constant section when equal forces act on the free end and equal moments therefore apply at the built-in section. This is a surprising conclusion, because such a member requires much less material.

The figures show a few examples of elastic dolphins. In some of them the cross section decreases from the built-in section towards the free end of the piles. These not only weigh less but are able to absorb much more energy.

Fig. 2 represents two wooden piles of equal dimensions. The first one has been driven "upside down", as it is usually to drive piles, and the second one has been driven in the position trees grow in the woods.

It can be easily seen that the position usually adopted (the first one above) is most unsuitable: not only has the smaller cross-section to resist the bigger bending moment but, furthermore, as the deflection of the upper part of the pile is reduced, the amount of energy the pile is able to store is very limited.

Should the piles have the dimensions shown in the figure, the energy that can be absorbed by the first pile is only 14-Kgm (100-ft. lb.) against 83-Kgm (600-ft. lb.) in the second pile. By merely inverting the position of the wooden pile the energy to be absorbed by the pile is increased 6 times.

To make the comparison possible it has been asumed that both wooden piles acted as built-in beams of equal length and would support the same working stresses at the built-in section. The second pile would, of course, have to be driven deeper, to provide the necessary increased support from the ground.

Fig. 3 represents two piles very similar to each other. One has been made up by cutting an I profile along the diagonal of its webb and, after one part has been rotated by 180°, welding together the two parts.

By this simple operation it has been possible, using the same amount of steel and adopting the same working stresses, to have a pile able to absorb nearly twice the impact energy.

Fig. 4 represents two piles consisting of pipe section. One is a pipe of uniform diameter and thickness (470 x 20), and the other is a pipe of the same diameter but of varying thickness. Although the second pipe is much lighter and probably less expensive, it is able to absorb a larger amount of energy.

It is hoped that this article will give some inducement to engineers to design dolphins of uniform strength, using the principles outlined in the text and illustrations.

Correspondence

To The Editor of The Dock & Harbour Authority.

Sir,

Common User Pipelines

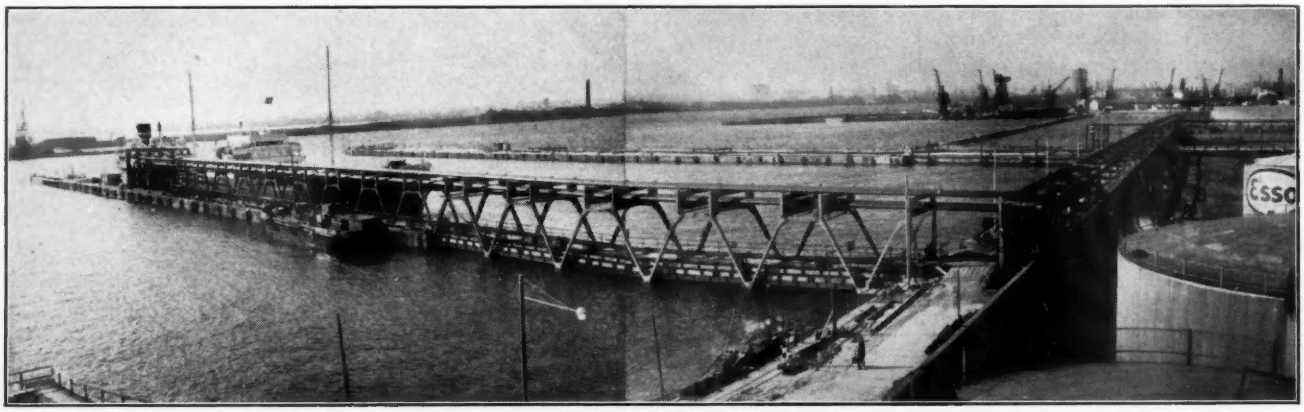
I read, with much interest, the report in the October issue of your Journal concerning proposed extensive developments at Avonmouth Docks. There is just one point upon which I would like to comment.

In the paragraph dealing with the common user oil pipeline project your reporter states ". . . . . it is believed that the Port of Bristol is the first in Europe to adopt such a system." This belief is not, in fact, correct as such a system has been operating successfully in Dublin since 1955, between the two post-war oil jetties and the oil companies' storage installations in the Port "Oil Zone."

All pipes are overground except at two places where they cross underneath roads through concrete or steel pipe sleeves. On the East oil jetty, which is comparatively narrow (about 35 feet in width) the pipes are at high level and are carried on reinforced concrete supports. Similar supports carry the pipes from the shore ends of both jetties to the installations.

The West jetty is about 80 feet wide and on it the pipes are laid on concrete sleeper supports, at or about deck level, and rise to high level at the shore end of the jetty to join the high level pipes from the East jetty.

The scheme includes a pumping station and a compressed air station for clearing the stripping lines of various products either by water or by air. Company owned lines are also carried on the supports that carry the common user lines. The provision of the



Oil jetties with common user pipelines at the Port of Dublin.

common user lines has, of course, had the intended result of keeping to the minimum the total number of lines from the oil jetties to the storage installations.

The scheme was initiated immediately after the end of the last war when the Dublin Port and Docks Board decided to separate the tanker trade from the general cargo and grain trades at Alexandra Quay and provide oil jetties for tanker discharge and loading at the Eastern end of the Port.

The accompanying panoramic photograph taken in March 1958, shows the two oil jetties, the pipe supports and portion of the Oil Zone.

Yours faithfully,
C. J. BUCKLEY,
Engineer-in-Chief.

Dublin Port and Docks Board,
East Wall Road, Dublin.
31st December, 1959.

To The Editor of The Dock & Harbour Authority.

Sir,

Simplification of Shipping Documents

Your editorial in the issue of December, 1959, on the subject of the simplification of shipping documents will, I am sure, raise sympathetic thought in the minds of all who have to deal with the movement of shipping and the loading and discharging of cargo.

While I agree that the review should begin nationally I would suggest that the requirements of Port Authorities need also to be included. Port Authorities are concerned in many aspects of the shipping industry in addition to carrying out their fundamental duties of providing docks, sheds, equipment and other facilities. When handling cargo they play an integral part in the sequence of events leading to the landing and delivery of import cargo and similarly in the receiving and shipment of exports. Unfortunately each interested party has its own set of documents. The Shipper, the Carrier, the Port Authority or Wharfinger, and the Shipping Company all act independently and have produced their individual system of documentation to suit their particular requirements. To devise a single uniform system of documentation to meet these various requirements would seem to be a simple matter **if all parties are willing.** Substantial economies of effort and of expense would result in which all would share the benefits.

Yours sincerely,
LESLIE FORD,
General Manager.

Port of London Authority,
London, E.C.3
4th January, 1960.

To The Editor of The Dock & Harbour Authority.

Sir,

Administration of Terminal Facilities for Overseas Trade

In his interesting letter W. H. Lait, in your December issue says " the interpretation of the word ' discharging ' may give rise to some difficult questions of fact."

Has the definition by L. J. Lord Dundas, in Dampskibsselskabet, Svendborg, v. Love & Stewart 1915, Lloyds Law List vol. 66, p. 74, ever been improved upon?

" One must distinguish between the operation of discharge and the disposal of the cargo, when discharged, by the consignee. **Discharge begins and ends as from the ship on to the quay or on to such appliances . . . as are customary at the port of discharge."**

The ship's rail therefore plays no part in the process of discharge and it never has done. It is as imaginary a line as the equator. The ship does not dump imports on to the ship's rail neither does the ship accept exports that have been balanced on the ship's rail. In both cases, as the learned judge so clearly saw, the quay is the place where the goods are landed and from where they are shipped, and, apart from overside transactions, it will continue to be so.

When your correspondent says " the obligation of the shipowner . . . is to . . . deliver the goods at the ship's rail to the consignee " he adds, with a knowledge that the above is impracticable, " that is, he must put them so far over the ship's rail as that the consignee can begin to act upon them." Surely the nearest practical point to the ship's rail normally is, as Lord Dundas pointed out, the quay.

Yours faithfully,
R. B. ORAM.

Cranleigh, Surrey.
31st December, 1959.

R/T Communications at Chittagong

The Commissioners of the port of Chittagong, Pakistan, have placed an order with Marconi's Wireless Telegraph Co. Ltd., for the establishment of a VHF radio/telephone network to improve ship-to-shore communications within the port area and the Kharnaphuli River. In addition to the installation of duplicate transmitters and receivers at the Port Office and at the signal station at Juldia, mobile stations for use in two harbour tugs and a pilot launch are also to be supplied. The equipment will conform to the recommendations of the international maritime VHF conference which was held at The Hague in 1957, so that all suitably equipped ships visiting the port will be in full radio communication with the port authorities. At present ships have to use visual signalling, megaphones and written messages.

The Problem of Documentation at Ports

Cargo Handling Formalities Impede Output

By Col. R. B. ORAM, O.B.E.

In our issue for October last, we briefly referred to a Seminar on Ports and Shipping Training for the Arab States which was held in Copenhagen under the auspices of the United Nations. The Seminar lasted from 4th to 29th October and was attended by port managers, engineers and other officials from the United Arab Republic, Jordan, Lebanon, Irak, Arabia, Yemen, Sudan, Libya, Tunis and Morocco.

In his opening address, Mr. Ove Nielsen secretary general of I.M.C.O. and director of the course pointed out that the role of the United Nations Organisation was well-known in the political sphere, and although activities in the fields of social affairs, economics, finance, and technical questions were less publicised the results achieved so far in these fields were just as important as those in political spheres.

The public seldom heard about the important achievements of the Technical Assistance Administration. The solid, continuous, patient work of that body was not spectacular; but the fact that it did not possess front page news value did not mean that it was of minor importance.

In the maritime field the Technical Assistance Administration had a list of solid achievements to offer. The work had required the services of about 20 experts of all nationalities and of various technical qualifications, who had worked in the Far East as well as in Europe and in Latin America.

These experts were attached to the various governments who requested help in connection with many different kinds of problems. These included:

Shipbuilding in the Philippines and Yugoslavia.
Training of ships' officers in Indonesia.
Ship operation in Indonesia and Latin America.
Hydrography, dredging and buoyage in India.
Port construction in Costa Rica, and Salvador.
Merchant Marine administration in Argentina, Honduras, Nicaragua, Costa Rica, Guatemala and Mexico.
Port administration in the Near East, Indonesia and Greece.
The safety of the ship and dock fire-fighting in Israel.

At the same time fellowships covering study in foreign countries were granted to Merchant Marine personnel; for example certain Chinese officials were sent to the U.S.A. and Canada to spend some time in various ports; Central American nationals were sent for a period to European Ministeries of Merchant Marine; and in Denmark, navigating and engineer officers from Indonesia had been accepted for training.

Seminars of the kind they were now attending were nothing new to the Technical Assistance authorities; a similar course was held in Costa Rica under the direction of Mr. Sanchez, the director of the port of Alicante in Spain, whose services were specially requested for the post. The seminar lasted several weeks and covered port administration and operation, and was framed specially for officials from about 10 Latin American countries.

The meetings in Copenhagen included a number of lectures on a variety of subjects, some of these being of interest to a wider field than that represented by the port officials who attended the course. Of particular interest was an address by Col. R. B. Oram, O.B.E., on "Cargo Handling Formalities" and as, in months to come, this controversial subject is likely to receive increasing attention throughout the maritime world, we are printing his observations in full.

THE realisation that no single cause more directly affects the cost of living of a maritime country than the turn-round time of ships in port, has focussed attention on the formalities that hinder the process of moving cargo into and out of a ship. Whilst the relevant documents for each unit of cargo have always been regarded as a necessary drawback, it is unfortunately true that the temporary absence or lateness of a single document is often sufficient to hold up the discharge of a ship or the movement of a parcel from the quay shed. The piece of printed paper is no longer the servant of industry, it has become its master; the cost of delaying the ship is many times that of the supposed risk of delivering cargo in the absence or irregularity of documents. Because in one case the shipping company stands the loss and in the other case the port authority or the master stevedore is not willing to take a risk, there is delay which has become accepted as a part of the business of manipulating documents. There is no one authority who is in a position to cut through the jungle of red tape that has grown up, encouraged by two wars, until it has become a standing charge on the commerce of a maritime state.

There is reason for the existence of the documents that at present trammel the flow of cargo. The function of each, broadly speaking, is to express and to limit someone's liability. The Bill of Lading limits the liability of the shipping company until it is difficult for the layman to discover what responsibility they take for the freight they receive. The shipping note requests the dock company to receive a certain number of packages; the description of the contents may be general or particular. The party issuing the document states clearly for what, and for how much, he will be liable; it is open to the party accepting the document —and the goods—to protect himself by clausing the piece of paper in anticipation of a third party claim. It is a system for which there is justification and it has grown up over the centuries.

Those who realised the drag that excessive documentation can become have recently been asking two questions:

(a) How much of this is really necessary.
(b) If we cannot do away with any of it, which we do not admit, then how can we, in this scientific age, rationalise and standardise the essential documents.

SEA FREIGHT AND AIR FREIGHT

Those who see no reason to tolerate the present jumble of documents, of which there is no standard form even among the separate types (a shipping note can vary from a piece of paper not much larger than a bus ticket to one the size of a newspaper —a Bill of Lading is of a size and texture that pleases the shipping company), have had their argument for simplification greatly strengthened since the encroachment of aircraft on the carriage of goods. They quote the number of documents required to enter and clear a ship and its cargo against those for an aeroplane. In New York a ship needs 22 documents against 4 for an aircraft. In Yokohama 32 against 3, Honolulu 46 and 3, Sydney 23 and 2, London 21 and 4, Copenhagen 21 and NIL.[1]

Whilst shipping documents have been allowed to proliferate, at the whim very often of the local customs or other authority, aircraft documents have been sensibly restricted by co-operative international action between the International Air Transport Association and the International Civil Aviation Organisation. The first body is an organisation of 76 private and government owned airlines and the latter, a specialised agency of the United Nations. It has thus the power to set limits to the demands of governments for information and statistics. This terrible hunger

by bureaucracy for figures, often of little or no value, with which to juggle at leisure, is the parent cause of much of the time-wasting form filling which afflicts the modern business office. The extent to which air freight documentation has been reduced to essentials is shown in the staff time taken to prepare a ship's manifest—30 minutes against 10.[2] It is apparent that governments have been persuaded to be satisfied with less information in respect of air freight than sea movements of cargo.

THE PRESENT DOCUMENTARY SYSTEM

Having, it is hoped, implanted the idea that the time-honoured methods of the carriage of goods by sea are not necessarily sacrosanct and that the hallowing by many centuries usage does not exempt a practice from criticism, let us look briefly at the main documents which support and prop up the present system. It is not proposed to detail the 46 documents that cannot but impede the work of entering and clearing a ship in Honolulu. It is freely admitted that whilst there is no rational limit to the filling up of forms, the refusal to do so, even though the purpose of the form is irrational, would merely block the movement of cargo by invoking the bureaucratic sanction.

It will also be convenient to separate the documents for cargo into those associated with imports, exports and warehousing.

(a) **Imports**

The Bill of Lading, the contract to carry the goods and which specifies at great length the conditions in which the carrier will operate. This is the most sacred of all documents, many forms until recently being couched in the stately English of the time of Elizabeth I.

The Manifest, which is simply a schedule of Bill of Lading, numbered consecutively. Whilst there is a record of the early manifest, dating from 2,000 or more years ago, it is still functionally, a domestic document prepared for the shipping company's convenience. It is hard to see how it is essential.

The Ship's Plan, is also not a document of title. It is convenient for the discharging stevedore to have the exact stowage of the ship in front of him. In the case of a casualty during the voyage, or of cargo shifting, it is there to be referred to. Probably its main use in in " plotting " the discharge in ports where a high proportion of the cargo is taken by a number of separate overside receivers.

A Release may take the form of a separate document. The release for delivery of a parcel may also be intimated by a clause stamped or written on the reverse of the Bill of Lading. Here there would seem to be scope for standardising the practice.

Tally clerks are employed in many ports to check deliveries from the ship, particularly when these are overside. The **Tally Card** prepared by the clerk is the evidence from which the pass, enabling the goods to leave dock, is prepared. When goods are landed into the custody of the shipping company, or into the hands of an impartial dock company, the practical value of a tally is not convincing. The expense of tallying general cargo, which was often quoted in London, prior to the late war, as around 5d. a ton is now considerably greater, the art of tallying not having noticeably improved in the last 20 years. It is a very moot point whether claims that would arise were no tally to be taken, would, over a period, amount to the cost of tallying, which burden has for long been accepted without protest.

It may be interpolated that no mechanical system of tallying has yet been found reliable. To the expense of tallying must be added the delay as each set is halted during the crane or winch cycle, so that the tally clerk can satisfy himself of the contents. The accumulated delay by the end of a working day, whilst it will depend on the efficiency of the clerk is and will remain so long as it is tolerated, a handicap to ship turnround.

Lighter Notes, or the pass which the lighterman presents at the dockside on leaving an enclosed dock are prepared from the tally cards. In many instances the total alleged to have been tallied is less than the Bill of Lading quantity. This subtraction of a few packages is generally accepted by the lighterman as the protective measure he knows it to be; it is done by the tally clerk to protect the ship's interest. That the parcel turns out correct at the receiving wharf is accepted without comment—not even to draw attention to the incorrect tallying.

Should the goods be delivered to land conveyance the driver will be issued with a **Dock Pass,** the number and description of packages followed similarly on the activities of a tally clerk.

Finally there are **Weight or Measurement Notes.** It may suit the convenience of the ship or the receiver to have the parcel, or a representative sample of it weighed or measured. In the case of cut timber, particularly hardwood, the process of measuring is a complex one.

(b) **Export Documents**

As with imports it is proposed only to describe the function of the principal documents. Taking them in the order in which they accompany the goods we begin with the **Shipping Note.** This, in form, is an entirely arbitrary document. It merely advises the port authority, in ports where the goods are shedded prior to shipment, or the shipping company direct in the case of overside traffic, that the conveyance contains a certain number of packages. Where goods are classed as hazardous, or as objectionable, then further information as to flash point will be given. In practice, the amount of information may be as little as the shipper wishes to give or the port authority require to safeguard their interests as warehousekeepers

But it is in the variety of texture and size that shipping notes cause delay. There is no set form which is everywhere accepted. Some shipping companies, in a praiseworthy desire for uniformity have gone to the trouble and expense of printing and issuing a form of shipping note that they consider will be convenient to handle. Its use by shippers is permissive only. Any piece of paper will serve as a shipping note. The time wasted by the export checker in coping with several hundred diverse papers is not simplified when there is rain and wind. Neither is the lot of the clerk who has to produce from this mass the next document in the export sequence—the **Mate's Receipt.** This corresponds to the manifest for imports and is a record of the cargo received for shipment. In due course the shipping company, through their clerk—the Mate has long since dropped out of the picture—will endorse the Mate's Receipt with "shipped" or "shut out" against the entry for each parcel. In some cases he will clause a parcel of, say, 500 rolls of wire, " 10 rolls in dispute." At other times he will make a qualification as to condition—so many drums of oil buckled or dented.

The Mate's Receipt is the basis on which the Bills of Lading are prepared and the remarks as to the quantity and condition observed at the time of shipment duly appear again on the Bill of Lading. The scrutiny which makes this possible is done by the export clerks employed by the shipping company. Their job is to watch the cargo as it leaves the shed to be shipped, to tally it to quantity and, where this is called for, to measure the packages. The results of this scrutiny are recorded on the **Export Checker's Card.** Once again we can see how a system has been built up around this continual obsession of liability. The author of this paper can say, from his long experience of handling export cargo, that in the great majority of cases the alleged shortage recorded, first on the checker's card, transferred to the Mate's Receipt and the Manifest and preserved on the Bill of Lading, does not materialise. In the case of some shipping companies the port authority who shed the goods use still another form to register

their dissent at the export checker's count. If the port authority's record shows 500 rolls of wire tallied from lorry or rail truck into the shed and the shipping company insist that only 490 rolls left the shed and were shipped, the solemn farce is enacted of preparing a **Protest.** On this document are listed the various parcels on which shortages are alleged and which are denied. The port authority seek to register, by handing this form to the shipping company, their protest. Except that it is just one more move in the game the protest has rarely been known to be of any value. Experienced port operators know that shortages have a way of finding their own level, provided no precipitate action is taken to settle them.

(c) **Warehousing Documents**

Here the author is only too aware of the impossibility of giving an accurate review of the documentary side of the warehouse work done in a port. London might be considered as the premier warehousing port in the world It has a long history of readiness, on the part of its dock owners and wharf proprietors, to carry out the most complex operations on import cargoes. In years of unremitting competition, to secure business from other ports more and more facilities in the way of processing goods have been provided Not only were some of these services of a major kind, such as refrigerated installations for the storage of meat, poultry and dairy produce, huge grain warehouses and also timber sheds, but over the years the staff, whose work lay with these specialised commodities, have acquired an expertise that has earned the respect and envy of the members of the various trades concerned. Importers of meat, timber, wine, spirits, dried fruit and many other commodities used the port warehouses as they would have done their own premises, the upkeep of which they were, by this arrangement, spared. The wool trade has for generations been content to have its imports shown, lotted and sold in the dock warehouses which are devoted entirely to this commodity.

Naturally this thriving business has produced a separate class of document, often more complex than those for the straightforward import and export traffic. Where goods may remain on hand for several years the definition of liability for quantity and condition becomes more important than with cargo in transit. Hence the highly complex systems of gauging wine and measuring timber, to mention only two of the staple commodities for which a warehousing port makes provision.

The essential documents can be briefly described. There is first the **Receiving Order** which constitutes the authority for the dock company or the wharfinger to take over the cargo which has in the normal way been discharged in the port. If necessary, arrangements are made for it to be brought from the place of discharge to the receiving and housing department. Here it is landed and the appropriate processes are commenced. When these are completed, all of them having had as their object the definition of liability by expert determination of condition and quantity, **Measurement, Gauging, Piling or Weight Accounts,** as the case may be, are issued. With cargo that permits of the process, samples may be drawn and the net weight ascertained. In this instance **Sampling and Taring Accounts** are issued. When the time comes for the goods to be delivered the owner presents a **Delivery Order** to the warehousekeeper authorising him to deliver the quantity on the face of the order. If this is less than the total quantity, as it may well be, a **Delivery Account** is prepared. In the case of hardwood timber this would be made up from the separate measurement of the planks delivered

If the buyer has so agreed, a **Rent Account** will also be rendered in respect of the quantity delivered. In some ports there is a further document known as a **Prompt.** It is issued by the owner of the goods and the purpose of this is to enable the buyer to take free delivery within the time shown on the Prompt, the seller paying the warehousekeeper's rent up to that date. A parcel of wine or sugar represents a large sum of money which may be locked up for a long period, when cargo is seasoning or maturing. To enable the owner to convert the goods into a security the port authority issue a stamped document of title known as a **Warrant.** This certifies that the goods named on the face thereof are held by the warehousekeeper to the account of the person at whose request the warrant has been issued. It is, in effect, a cheque, accepted by the holder's bank, the goods figuring instead of the sum of money. As the parcel is reduced by deliveries, or transfers on sale, to separate buyers, the warrant is re-lodged with the warehousekeeper who sees that it is suitably corrected. At all material times he is liable for the production of the balance of the goods on the face of the warrant.

No mention has been made in this brief survey of cargo documentation of the manifold documents required by the national customs. Not only is it not possible in a limited survey of this kind to give a description of each, but the shippers and importers of goods find that in many ports customs officers demand a tedious flow of documents, a few of which have any direct bearing on the fixing of duty. The ungovernable urge for statistics finds ready expression through the national customs, to the delay and frustration of the legitimate movement of cargo.

(d) **Advance Information**

There is a class of document which is austerely functional and which if correctly prepared, is of great value. This is the ship's stowage plan—a sheet of paper on which the conventional outline of a four, five or six hatch ship, with the appropriate 'tween decks, is drawn. In each hold, in the correct spaces, is shown in block form, the cargo as it was stowed at the loading port. It is not, in fact, strictly a " plan " of the stowage, but an " elevation " as it is not, of course, possible to represent diagrammatically the exact position of each parcel in relation to its neighbour. An experienced stevedore can see immediately from the plan the nature, extent and position of each parcel, or class of cargo (if there are 10 Bills of Lading for oranges, for instance, the plan would merely give the full number of packages of oranges, the exact marks being ascertained as the stowage is broken down).

Years ago the discharging stevedore was not able to make advance arrangements for his labour, because the ship's stowage plan was carried with the ship's papers. Until the vessel berthed, her contents remained a mystery. True, it was possible for the Overseas agents to mail the London office with a copy of the stowage plan, but the fact remained that they rarely took this trouble. It may not have been realised how valuable the information on the stowage plan could be. Today there is no excuse for not sending the plan well in advance by air-mail.

In the extremely simple case of a vessel fully laden at one port and completely discharged at another the ship's plan is valuable. It will tell the stevedore about hazardous or dangerous cargo and where to find it in the ship. It is actually an index to the contents of the ship.

Few ocean-going vessels are limited to one loading or one discharging port. The eternal problem, from which shipowners are never free, is how to stow a ship that may load along the coast, at a dozen different ports, with cargo that has to come out, in the right order, at half-a-dozen discharging ports. These are the circumstances in which a correctly prepared ship's plan will save time and money. If the stevedore knows what he will find when he takes off the top hatches he can order his ship and quay gangs and warn the overside receivers. Similarly, when the vessel carries Optional Cargo, that is, cargo in respect of which the consignee may exercise his option, under the Bill of Lading, to take delivery at one of several ports, it is most necessary that the

position in the ship of this cargo be clearly defined. If this is done it is possible to avoid the expense of landing and re-shipping, dumping or re-stowing, all of which cause delay in the turnround of the vessel.

Whilst inaccuracy in cargo documents may cause correspondence and an occasional loss, a badly prepared ship's plan is a certain way of wasting time and money in the discharge.

WHAT IS BEING DONE TO REDUCE DOCUMENTATION?

Since the late war a lot of thought has gone into the very perplexing problem of reducing the formalities that many causes have combined to inflict on the carriage of goods by sea. In attempting to list these we may mention those which are general, omitting the very many that are local:—

i. The natural desire to define and to limit the liability of each party in the process of transporting cargo.

ii. The number of interests involved, shipowners, port authorities, commercial interests including transporting companies, lighterage, road and rail; government authorities, customs and others. Collectively they have made it impossible, in the absence of one co-ordinating authority to impose a simplification.[3]

iii. A general acceptance of the principle that nothing can be done singly to reduce the mass of paper that has come to be associated with cargo handling.

iv. Very often the persons who are most knowledgeable on the faults of the system have no incentive to alter it—they see no reason to work themselves out of a job.

v. This applies at a much higher level with government officials who juggle with lifeless statistics and whose careers depend on a continuance of time wasting form filling, at lower levels.

The annual leakage to the industry caused by the time wasted whilst officials justify their job by querying the information on these forms, has been estimated at many millions of Danish Kroner, in the Free Port of Copenhagen, where about 10,000 vehicles pass through the dock gates daily. "Not many quarters of a hour have to be wasted before such sums are reached".[4]

Attention has been paid to the problem by bodies such as ILO, ICC, ICHCA, PIANC and OEEC. All of these have done a great service in attempting to provide the public they each reach with an understanding of the steady loss to which industry has for too long tamely submitted. The attempts made may be very roughly classified:—

i. Proposals to abolish certain documents as obsolete or unnecessary.

ii. Whilst admitting that it would be desirable so to do in many cases, practicable proposals have been made for the rationalisation and standardisation of the documents required to clear a ship and her cargo.

In regard to the first and more drastic attempt it will be common knowledge that it is far easier to impose a new form on a long suffering public than it is to obtain agreement to do away with it. It does really seem that the shipping and cargo business will accept additional fetters, making only a token objection; any attempt to strike off those fetters will be met with a howl of protest.

Where the most encouragement for the future lies is in the rationalisation of forms. Put briefly, this process means saying to the interested parties "We know you must have your Bill of Lading, your Releases, your Shipping Notes and the rest of the paraphernalia but surely we can do all this in a better way than it has been done over the last 100 years. As well as better and faster ships and up to the minute equipment for handling cargo, there have been some tremendous improvements in the processes of preparing documents. Why not have all your forms made of the same size and texture of paper and have this an internationally standardised size?" To go a stage further—"Why not devise a form based on the 'window' principle which means that the interests concerned can fill in their own particular batch of documents, simultaneously on an ordinary typewriter? If we put a tooth comb through the existing forms, alter and amend them and then, having incorporated those features which are essential and also common to each, use different colours so that the form is self-explanatory, surely your clerical costs must be reduced and your present frustrations avoided."

These are the lines on which the General Export Association of Sweden, aided by subsidies from the government and the trade, have worked with considerable success. They have rightly contended that where "each and everyone deals in his own way with the information he considers is required in his forms, without paying any consideration to how others have dealt with theirs",[5] the conditions cry out for a new and sensible approach. The manner in which the survey was tackled can be very briefly described. Leaving out the forms used domestically by shipping companies and others, the committee examined the forms which were in public use. These were in the following functional categories:—

i. Customs documents—among these were forms of declaration required by the Swedish Customs Board. It was, of course, realised that some adjustment in the wording would be necessary to adapt these to the requirements of other countries.

ii. Transport—this was a most important survey for it covered Bills of Lading, Mates' Receipts and Booking Notes.

iii. Insurance—efforts were concentrated on standardising the different types of policies.

iv. Payment—these were forms required by the Currency Control Authorities. Like shipping notes, it was found that there are almost as many types of documentary credits as there are banks.

v. Documents of Origin—the form that these take has been decided by the various Chambers of Commerce; there is not at present a standard form.

vi. Forwarding—there was a need for standardising the form for instructing agents.

vii. Licensing Documents—it was decided to omit these from consideration as they would gradually go out of use.

The result of this classified scrutiny has been the incorporation in the report of nine "model" documents, each being of uniform size, texture and lay-out. Of these, the first five are of major importance.

i. **Mate's Receipt**—Here a separate form for each consignment is suggested; this differs from the practice with many shipping companies of listing consignments on a single sheet of the "manifest" type. It has, however, the advantage of providing more space for qualifying clauses i.e. "5 packages in dispute", "3 barrels leaking" etc.

ii. **Bill of Lading**—Like the Mate's Receipt this model form opens with a division into two spaces separated by a short vertical line. In the left hand space is inserted the name and address of the consignor; in the right hand space the name of the firm to be notified. It is all very clear and will save a lot of searching. The essential preamble is printed at the bottom of the form and the usual clauses are to be found on the back. The committee suggests that, with certain additional information inserted, this form could be used also as a through Bill of Lading.

iii. **Certificate of Origin**—the model has been drawn up after consultation with Swedish Chambers of Commerce. After a recital of the consignment details (in the same order and position on this form as on the other eight) there is space for a certificate by the local Chamber of Commerce attesting the manufacture in Sweden of the goods.

iv. **Insurance Policy**—This has been worked out in conjunction with the Association of Swedish Underwriters, who consider

it suitable for staple exports with regular overseas markets; they think that for more complex wares, routes and buyers, more may be needed and that this may involve discussion with assurers, leading to special policy forms adapted to their particular requirements. The printing of general insurance conditions on the back of the form should do away with the present cumbersome use of adhesive slips.

v. **Shipping Instruction**—The Federation of Forwarding Agents Association in Sweden have agreed this. It is for the use of the exporter and is in duplicate, the top copy being the Shipping Instruction and the second copy the confirmation. It is intended that the exporter on giving his instructions should send both copies to the agent who will, in due course, return the signed confirmation to his principal.

The remaining "models" are export goods declaration, booking order and confirmation, export declaration and an application to sell foreign currency.

Enough has been said in describing the forms to suggest the method by which the documentary process can be simplified. Seeing that the essential details cover each other exactly when the forms are laid on top of each other **a number of related documents can be completed in a single office operation.**

From a master copy, this can be done on a typewriter or by one of the different types of duplicating machines now on the market. The employment of a common reference number on each of the relevant documents throughout the transaction is important and will greatly aid immediate recognition of the consignment. The authors of the Report have, in fact, gone out of their way, in an appendix to the Report to make several helpful suggestions on the best way to tackle the clerical side of the new system.

Nothing provides a greater aid to the clerk handling forms for hours at a stretch than the use of distinctive colours by which he can identify, not only documents, but those portions which they have in common. With the model forms this has been done to the extent that not only is each one instantly recognisable but details which are identical are printed throughout in the same colour.

CONCLUSION

Whilst to those who in the past gave thought to the removal of the documentary handicaps in the flow of cargo, it seemed that only a painful inch could here and there be gained, the success of the Swedish Exporters scheme is a direct encouragement to tackling the larger problem of import documentation[6]. Standardising means producing a set of forms whose very simplicity converts the rationally minded shipowner. Gradually Scandinavian shipping lines are seeing the advantage to be gained from the simpler system. As their competitors adopt it fewer can afford to struggle along with the imposed handicaps of an obsolete routine. The major Norwegian shipping firm of Fred Olsen and Co. have announced that from November 1959 they too will be operating the standardised Bills of Lading.

There is also a wide field open, in the study of means by which advance information can be made available. We have referrred earlier to the real value of an accurate ship's stowage plan and have mentioned the straightforward case of the ship that discharges her entire cargo at one port. Seldom however does this happen. More often a cargo vessel functions as an omnibus carrier. When she leaves her last loading port the stowage plan should then be air-mailed to the first discharging port, which we will call port A. Here the cargo consigned to this port and also cargo which it is convenient to remove there in order to save the expense of calling at port B, will be discharged. The stevedore at port C requires the stowage plan, correctly amended by port A, prior to the vessel's arrival. If ports A and C are not far distant special means will have to be taken to get the document there before the ship arrives. At port C cargo is taken out and also coastwise cargo for ports F and G is loaded. Once again, a correctly amended plan is required, not only for ports D and E but also for F and G. So the process continues until there the resemblance to the cargo which left the overseas loading port gets less and less. With the more important shipping lines it is not difficult to secure the co-operation of each agent in the chain of ports. With the smaller vessel whose discharging and loading is arranged by separate agents, co-operation is called for. The benefits of such co-operation are too obvious to need emphasis.

For many years firms importing goods into London have found it economic to make use of a facility provided by the port authority. On the payment of a small sum, the latter prepare and pass the Custom's entry and ensure for the importer that there is no hitch in the clearance of the goods. The small staff employed at this central servicing bureau are experienced in the intricacies of customs procedure; they pride themselves on being abreast of the frequent amendments to codes and schedules of duty, to a standard with which the private firm could not compete. A small importer can thus, for a few shillings, hand over this complex work to a specialist. In this well established facility surely there lies the key to a wider application that would embrace a great deal more of the documentation than is contained in the Customs requirements[7].

A central dispatch depot in each port could afford to equip itself with the latest and most expensive machines for duplicating and other processes. They would be far beyond the means of the small importers.

Finally, whilst experts have been trying to pin a rationalised system of documents on to general cargo, this latter has not by any means been standing still. Once again we are up against the axiom that no single change can be made in accepted methods of cargo handling, without the change having effects beyond those visualised by the inventor. A real reason for the number of forms and the complexity of documents lays in the practice of shipping small parcels. A vessel loading at an open roadstead may carry 100 parcels of Mauritian sugar in bags. When each craft that tenders its load to the ship demands a separate Bill of Lading this is by no means an exaggerated figure. The total deadweight tonnage carried may be around 7,000-tons. Discharging to separate Bills of Lading is a slow and tedious job with much manipulation of documents. When the same ship carries 7,000-tons of sugar in bulk, only one Bill of Lading is necessary. As the size of the cargo unit increases the documentary work decreases, although this was most certainly, not the primary motive for converting sugar carriage from bag to bulk. Between the two extremes comes the unit load and the container. The former, palletised, may weigh a ton, the latter when carried by certain United States vessels may weigh nearly 40-tons. It will indeed be surprising if those who are at the present time nurturing this new and very important traffic have not their eyes wide open to the obvious saving in reduced documentation. Just as mechanisation is reducing the demand for the unskilled docker, so the trend towards larger cargo units will make unnecessary the routine filler-up of forms—the man who is responsible for the major cargo handling formalities that do very little or nothing to aid the turnround of ships in port.

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3. Administrative factors retarding the handling of goods on the pier—Axel Bronoe, General Manager, Copenhagen Free Port. Technical Conference of I.C.H.C.A., San Sebastian, 1958.
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7. Axel Bronoe op.cit. item 3.

Extension of East Wharf, Port of Singapore

Details of Construction

Readers of this Journal will remember that in our issue for February 1958, we published a Report of a Commission of Enquiry into the working and administration of the Port of Singapore. One of the recommendations of the Commission was the development of the Eastern Lagoon area in order to provide additional facilities for ocean going ships. The Singapore Harbour Board has now published details of the extension of East Wharf, which is the first stage in the development of East Lagoon.

The overall development will provide nine berths (Nos. 44 to 52) with space available for two additional berths in the rear of the breakwater. The arrangement of the quays is based on an approach basin of 800-ft. width and conforms to a pattern suitable for layout of road and rail access to the quays and other services.

The detailed arrangement of this extension is shown on the accompanying plan.

Construction. The quay is composed of a reinforced concrete platform deck supported on vertical reinforced concrete piles. The construction makes use of a large number of uniform sized precast deck units seated on cast-in-situ beams spanning the piles. An insitu concrete slab is placed above the precast units with a resulting monolithic deck slab able to support the vertical and longitudinal loads to be carried.

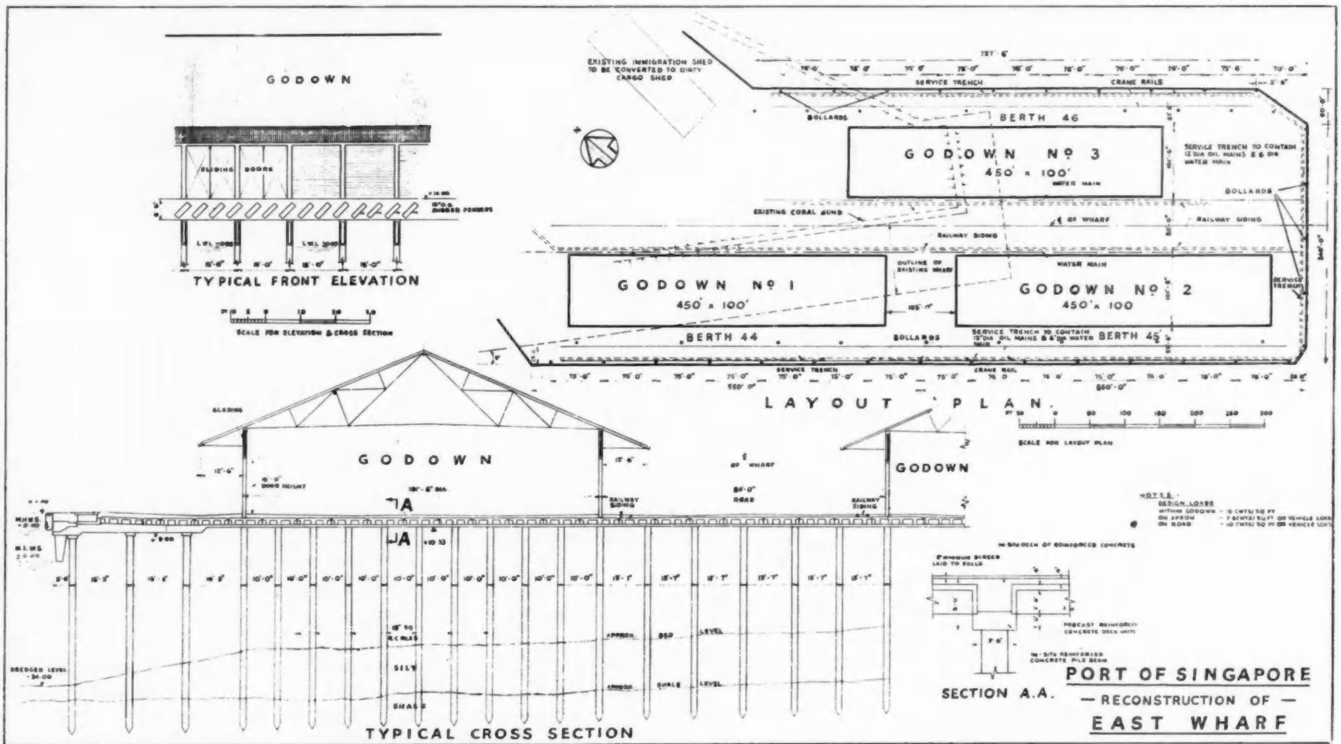
Surfacing. Over the structural concrete a screed will be placed in which provision will be made for falls to accommodate rain water run off to drains through the deck.

Services. Within the deck provision will be made for water, oil and electrical services and also rail tracks for railway sidings and wharfside cranes, should it be decided to instal these at a later date. It should be noted that the service pipes are placed sufficiently near the surface to permit easy fabrication, placing, maintenance and replacement, as well as to accommodate the use of precast units. Lead-offs from the mains will supply hydrants.

Fendering. It will be appreciated that in transmitting berthing forces to the deck structure, the nearer these forces can be brought to the level of the tops of the piles the more efficient and economical can the structure be made.

With this end in view the deck is constructed with only a relatively small face against which large ships will berth, which is protected by rubber fenders to give the necessary energy absorption of a 40,000-ton vessel with a speed of approach of $\frac{1}{2}$-ft./sec. striking over a length of 20-ft. of quay face.

Vertical diaphragms braced back into the deck structure are provided in order to keep steel lighters and similar craft from being trapped under the deck on a rising tide. Steel cope bars have been set in the front of these diaphragms to protect the structure against abrasion from these craft.



Bollards to take a 50-ton pull will be provided at the positions shown on the plan.

Godowns. A standard godown of 45,000-sq. ft. superficial area is allowed for at each berth. The 105-ft. clear distance between the ends of sheds 1 and 2 is such as to come in line with the pile bents which are at 15-ft. centres.

Construction Methods and Procedure

The construction is composed of vertical piles which can be driven from shore and gantry type piling rigs.

It is envisaged that Berth No. 46 will be constructed first and brought into use before closing present Berth No. 44 and reconstructing the new line—berths 44 and 45.

The diaphragms across the front rows of piles will be precast and placed from the Harbour Board's floating crane and will entail the minimum amount of between-tide insitu work.

The dredging of the new berths can be done before or after construction and be a separate operation.

The consulting engineers are Sir Bruce White, Wolfe Barry and Partners, and the direction of the contract is under the Chief Civil Engineer, Singapore Harbour Board.

Modernisation of Penang Ferry Service

New Terminals and End-Loading Ferries

(Specially Contributed)

The first regular ferry service in Penang was started in 1893/94 and was operated between Kedah Pier on Penang Island and various landing places in Province Wellesley on the mainland, small steam launches being used to carry passengers and goods. The ownership of the service was in private hands until December 1924, when it was acquired by the former Penang Harbour Board, which set out to improve and enlarge the service and to make it capable of carrying motor cars. The Church Street Ghaut Pier on Penang Island and Mitchell Pier at Butterworth were completed in 1925. In the same year a new steam ferry vessel "Seberang," built by the Singapore Harbour Board for the conveyance of both passengers and motor cars was put into service.

Again, in 1929, the piers were enlarged and two new and larger ferry vessels, "Tanjong" and "Kulim" were introduced into the service, and with the three vessels a half hourly service was run.

In 1938, the capacity of the ferry service was augmented by the addition of a still larger vessel, "Bagan." "Seberang," which was too small and no longer required, was sold. The service was operated with the fleet of three vessels, "Tanjong," "Kulim" and "Bagan" until the Japanese invasion in December 1941. Early in the war in Malaya, "Tanjong" and "Kulim" were sunk in Penang harbour and "Bagan" was taken to Sumatra where she fell into the hands of the Japanese.

Following the liberation of the country in 1945, the ferry service was recommenced by the British Military Administration with four tank landing craft and "Bagan," which was recovered in Sumatra and brought back. After its reconstruction in April 1946, the Penang Harbour Board took over the fleet and the four tank landing craft were modified and reconstructed at Bagan Dalam Slipway to provide seating accommodation for passengers. These vessels, together with "Bagan" have been in continuous service until the present time.

The volume of traffic carried by the ferry service during post-war years has increased rapidly. In 1946, the number of vehicles carried was 247,000. A decade later, in 1956, it was 711,000 and in 1958 a record number of over 814,000 vehicles was carried.

The planning of the new service was taken in hand by the Penang Harbour Board and its Consulting Engineers, Sir Bruce White, Wolfe Barry and Partners.

The Ferry Terminals

Preliminary investigations into the provision of a new and improved ferry service were first started in 1953. At this time it was decided that the advantages of end-loading operation were so great that this method should be adopted and that the vessels should be capable of berthing end-on across the strong tidal currents. This was achieved by the adoption of Voith-Schneider propulsion.

The question of capacity of the new service was investigated but it was extremely difficult to forecast rate of growth of traffic owing to the rapid increase of vehicular traffic in the Federation of Malaya at this time. In planning a permanent installation of this nature it is necessary to take a long term view to avoid subsequent congestion and overcrowding. With the provision of twin berths at each terminal it was estimated that a five minute service could eventually be handled provided the number of ferries were increased proportionately and this would provide capacity for traffic at existing levels and also for anticipated requirements for many years ahead.

The layout of approach roads, booking arrangements, holding areas and loading facilities were therefore based on this frequency of service. Other major considerations were the complete separation of pedestrian from wheeled traffic, control of pedal cycle traffic, provision of adequate approach roads and parking facilities, and access for private and public service vehicles.

For the Penang terminal, there was no suitable land available. A reclamation scheme was embarked upon and the terminal sited at the southern end of the planned reconstruction of the Weld Quay wharf facilities. It was decided that the pier head should

Butterworth Terminal showing berthing jetty and passenger ramps.

be sited in sufficient depth of naturally maintained water to avoid the necessity for continuous and costly maintenance dredging, and owing to the very shallow and slightly shelving foreshore it was therefore necessary to site the pier head 800 feet from the existing Weld Quay wall.

The approach road and car park arrangements covering an area of approximately 100,000 sq. ft. enable passengers arriving by car, taxi or trisha to be set down at the terminal building adjacent to

The new Penang Terminal as seen from Weld Quay.

the booking offices, and a considerable area is provided for a build-up of vehicular traffic clear of the public roads. Pedestrian traffic is admitted through four booking lanes, two at either extremity and from these access to the pier head loading point is by long gently sloping ramps and a central high level gangway supported from the main roof girders. The pedestrians enter and leave the ferries from high level connecting ramps.

Wheeled traffic enters through seven separate booking lanes, two for cars, two with weighbridges for trade vehicles and one each for bicycles, motor cycles and priority traffic. The vehicle deck of the jetty provides a large unobstructed holding area for at least two ferry loads of vehicles booked in and ready to proceed on to the ferries.

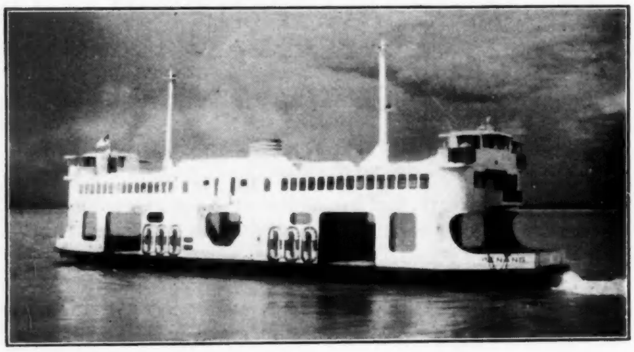
The ramps providing access from the jetty to the ferry deck are 65-ft. long and operated by hydraulic cylinders, the whole system being remotely controlled from a central control room. The final connection from the ramps to the ferry deck is by means of 14-ft. long electric winch-operated drawbridges. Once the drawbridges

are landed on the ferry deck the whole system comes under automatic control and is self-adjusting for alterations in tide level and changes in trim of the vessel.

The construction of the jetty consists of a combined precast and cast in situ reinforced beam and slab construction formed on reinforced concrete piles averaging 65-ft. in length. The superstructure is fabricated steelwork with asbestos cement cladding.

The Butterworth terminal is similar in layout and construction but the requirement for customs examination of pedestrian and vehicular traffic has necessitated a slightly more complicated layout. The terminal is designed to afford easy connection with the proposed Malayan Railway Station at Butterworth, should this be constructed in the future.

Office facilities are provided at each terminal over the booking offices, and provision has been made for toilets, canteens, etc. for the terminal staff.



One of the new end-loading ferry vessels.

The Ferry Vessels

The five new ferries are end-loading and have two decks, the upper one for pedestrians and the lower one for vehicles, access to these decks being obtained from the terminals by two separate gangways at different levels. They are capable of travelling in either direction with equal facility. The vessels, as well as the new terminals, are designed for end-berthing, which eliminates the loss of time at the terminals by vessels manœuvring to berth or get clear.

The prototype of the new vessels, "Pulau Pinang," was constructed by the Singapore Harbour Board and put into service in June 1957. The other four vessels were built at the Cheoy Lee Shipyard in Hong Kong and incorporate certain modifications and improvements which were found to be necessary as a result of experience with the prototype.

Each of the ferries has two Voith Schneider propellers size 16E, placed one forward and one aft, having blades 100 mm. long rotating at a diameter of 1,600 mm.

Two Crossley four cylinder vertical diesel engines of 380 h.p. each, are installed on each of the ferry vessels to drive the Voith Schneider propellers. These engines operate under optimum conditions at all times irrespective of the vessel's speed or movements since there is no change in their revolutions or direction. The vessel's speed and steering are controlled from the bridge through a speed control wheel and two steering wheels which are operated by one man.

Each vessel has seating accommodation for 460 passengers and can carry 32 medium sized motor cars at a normal service speed of about 10 knots. Life saving equipment on each vessel consists of adequate provision of life jackets with 10 buoys and 12 life rafts in addition. Each vessel has tank capacity for 20 tons of fuel and 10 tons of fresh water.

The principal dimensions of the vessels are:

Length	161 feet
Breadth	34 feet
Gross Tonnage	332 tons

Modernisation of the ferry service involved capital expenditure as follows:

New Ferry Vessels	$7,700,000
Ferry Terminals	$4,900,000

Permanent International Association of Navigation Congresses

Abstracts from the Annual Report of the British National Committee, 1958/59

A meeting of the Permanent International Commission was held in Brussels on 2nd June, 1959, at which the British National Committee was represented.

The meeting commenced with a tribute to Mr. Robert de Naeyer who, after a long association with P.I.A.N.C. died suddenly on 7th December, 1958. He was President of the Association from October 1947 until he took over the duties of Secretary-General in June 1956.

In addition to various routine matters, including reports on new members, the report of the Executive Committee and financial returns, the following items were discussed:—

a) **Appointment of Acting Secretary-General**

The meeting approved the nomination, by the Executive Committee, of Mr. H. Vandervelden as Acting Secretary-General of the Association for a period of three years. Mr. Vandervelden is Chief Engineer-Director of the Ponts et Chaussées and assistant to the Director-General of Waterways.

b) **XXth International Navigation Congress in Baltimore, 1961**

The opening date of the XXth Congress in Baltimore was fixed as 11th September, 1961. At the suggestion of the British delegation, the Executive Committee undertook to investigate further the possibility of organising group travel, at reduced rates, for European Congress members.

The programme of Questions and Communications for this Congress was approved, and the details are published below.

c) **International Commission for the Study of Depths in Seaports**

It was decided that, as the subject of berthage for large ships is to be dealt with at the XXth Congress, a final decision regarding the setting up of an international commission on depths in seaports be deferred until after the Congress.

d) **Date and Place of Next Meeting**

The next meeting of the Permanent International Commission was arranged, at the invitation of the French delegation for 31st May, 1960 in Paris, followed by the usual technical excursion. In this case, the visit will include a boat trip from Lyons down the Rhone and a visit to the region of Marseilles to see hydraulic works and the new dry dock under construction.

The invitation extended by the Norwegian delegation on behalf of the Scandinavian countries was carried forward to 1962.

New Study Commissions

Following the conclusions and wishes expressed at the XIXth Congress, the Permanent International Commission invited the

National Committees to prepare reports on (a) the study of the rationalisation of the handling of general cargo and (b) the study of improvement of the berthage for large oil tankers. The British National Committee decided to set up working parties to make recommendations on the bodies who should be invited to be represented on the Committees, the procedure to be adopted in drafting the reports and the scope of the reports in relation to the texts of the official conclusions and wishes expressed at the 1957 Congress.

Membership of the British Section

The present membership figures are:— Life Members 48, Private Members 87, Corporation Members 70, Total 205.

PROGRAMME OF QUESTIONS AND COMMUNICATIONS

To be discussed at the XXth International Navigation Congress, Baltimore (U.SA.)—September 1961

Section I—Inland Navigation

Questions

1. Criteria for the economic justification of new inland navigable waterways or the improvement of existing ones.—Criteria affecting the choice of new means of communication: water, rail, road or pipelines.—Effects on the creation of new activities taking into consideration the various interests which may be concerned, with special regard to the case where the new waterway would be required to serve regions in which the means of transport are not fully developed.

2. Navigation engineering problems in a system of multiple purpose dams, including:
a) Layout of sailing line and navigation aids.
b) Effects of hydro power peaking and flood control operation on navigation.
c) Location and layout of locks and approach channels.
d) Filling and emptying systems.
e) Economic considerations in determining size of lock chamber and dimensions of guide and guard walls.
f) Automatic operation.

3. Measures to be taken to ensure uninterrupted day and night navigation under all weather conditions.

Communications

1. Propulsion of vessels by push-towing:
a) Equipment for pushing: (i) Pushers (push-towboats), (ii) Push barges, (iii) Design and arrangement of couplings.
b) Pushed tows (trains of barges): (i) Formations, (ii) Dimensions.
c) Dimensions of pushed tows (trains) admissible on a navigable waterway (lake, river or canal): (i) Width of channel, (ii) Bends (radius, width), (iii) Density of traffic, (iv) Locks.
d) Navigation of pushed tows (trains): (i) Speed, (ii) Stopping, (iii) Manœuvrability, (iv) Width taken up in the bends, (v) Backing and lateral movements, (vi) Crossing and overhauling (overtaking), (vii) Influence of currents, waves, winds.
e) Handling of push barges detached from the tow (train).
f) Push-towing and other modes of navigation on the same waterway.

2. The development of waterway transport on shallow rivers or waterways of modest dimensions; barges and operational plant for such waterways.—Deepening of a navigable pass by means of periodically repeated operations (dredging, "bandelling"*, etc.).—Possible ways of overcoming the difficulties in underdeveloped countries: shortage of funds and of technical staff.

* "Bandelling" is a method used in the Far East to improve the pattern of currents by means of local narrowing of the navigable pass with temporary screens.

3. (Communication common to Sections I and II)
a) Economic layout of structures for the mooring of ships where the banks are sloping or vertical.
b) Equipment and methods for the loading and unloading of cargo as well as for transhipment; relation to road and rail transport.
c) Installations at ports for the loading and/or unloading of cargoes in bulk (ores, coal, etc.) excluding liquids, and for their reception and redistribution.
d) Possibility of utilising the same plant for different sorts of materials.

Section II—Ocean Navigation

Questions

1. Further study from previous Congresses (XVII, XVIII and XIX) of:
a) Design and construction of terminals (jetties, dolphins, moorings, etc.) for large ships (oil tankers, ore carriers, etc.) in the open sea, estuaries and large rivers.
b) Permissible height of waves.
c) Velocity at impact.
d) Mooring appliances.
e) Foundations, especially in soft ground.

2. Orientation and layout of accesses to seaports and the improvement of the channel as far as deep water.—Increasing the depth and maintaining it.—Influence of currents, waves and wind and of the transport of bed material.

Communications

1. Measures to be adopted for the accommodation of nuclear powered ships in maritime ports.

2. Raising and/or removal of wrecks.—Refloating of stranded or sunken vessels.

3. Methods of determining sand—and silt movement along the coast, in estuaries and in maritime rivers. Use of modern techniques such as radioactive isotopes, luminophors, etc.

The definition of a "Question" on the one hand and of a "Communication" on the other hand is as follows:

A "Question" is either a statement of the way the subject was dealt with in the country of the author or an account on a new theory applicable to the subject. When dealing with a "Question" the author submits his work for discussion to the Congress members; this may or may not be followed by the vote of conclusions.

A "Communication' is an account of the way in which the problems raised by it were solved in the country of the author. It aims at increasing the existing documentation on a specified matter and with this object the author imparts his work and the experience gained. By its very nature, a "Communication" does not lend itself to the drawing up of conclusions.

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Instructions and rules for the preparation of papers can be obtained from the General Secretariat, 60 rue Juste Lipse, Brussels 4, Belgium.

Traffic at the Port of New York for 1959

According to the shipping returns of the Maritime Association of the Port of New York, a total of 27,260 vessels called at the port during 1959, compared with 26,281 in 1958 and 25,844 in 1957. Arrivals totalled 13,597, comprising 5,651 American and 7,946 foreign ships, compared with 13,134 (5,659 American and 7,475 foreign) in 1958. Sailings for 1959 amounted to 13,663 (5,684 American and 7,979 foreign) as against 13,147 (5,216 American and 7,931 foreign) for 1958. During the past year 194 new vessels made their maiden voyage to New York.

Fluorescent Substances as Tracers for Studying the Movements of Sand on the Sea Bed

Experiments Conducted by the U.S.S.R.

By Professor V. P. ZENKOVITCH

Head of the Shore Department, Institute of Oceanology of the Soviet Academy of Sciences

THE problem of observing the movements of sand on the sea bed or on the beds of rivers has long been receiving the attention of investigators. German scientists used pieces of coloured glass as a "tracer" for studying such movements[10 11] but they were unable to obtain worthwhile results by this method on account of the poor contrast between the colour of the glass and that of the natural sand, which made detection difficult. In 1940 Soviet investigators carried out tests with aniline dyes as a means of colouring the sand itself, but this method likewise proved rather disappointing. In recent years, good results have been obtained with radioisotopes. These provide a very reliable means of detection, but are much more expensive than the fluorescent tracers described below. In addition, the latter have the advantage that a whole series of measurements can be carried out in the course of one season and at one and the same spot, whereas with radioactive tracers the relatively long half-life of these substances has to be allowed for.

The first entirely satisfactory results were obtained in the Soviet Union by treating sand with fluorescent marker dyes which possess the property of emitting strong light when subjected to ultraviolet irradiation. Suitable techniques for applying this principle to practical problems have been developed by a group of scientists attached to the Institutes of Oceanology and Organic Chemistry of the Soviet Academy of Sciences, under the direction of the author and of V. K. Matveiev.

The procedure is essentially as follows. Grains of sand taken from the area under investigation are subjected to a treatment whereby they are covered with a film of a hydrophile colloid incorporating a fluorescent dye. The sand is dried and is then deposited on the sea bed at a selected spot. Then, at definite intervals of time (ranging from a few minutes to several days), samples of sand are taken at varying distances from the point of deposit and are examined with the aid of a luminoscope. In this apparatus the specimen of sand under examination is exposed to ultraviolet rays, which cause the grains treated with fluorescent dye to emit light. This provides a convenient means of ascertaining how far and in what proportion the sand has been transported. The fluorescent grains are clearly distinguishable from the ordinary ones; thus, a single "marked" grain can readily be detected among ten million untreated grains.

The colloidal film enveloping a treated grain of sand gradually dissolves in the water. When it has entirely disappeared, the sand has lost its fluorescent property, and the test may be repeated with a fresh batch of treated "tracer" sand. Certain difficulties in the examination of the samples may arise from the presence of small fragments of shells or of relatively rare mineral constituents possessing natural fluorescent properties of their own.

Tests based on the method of investigation outlined above were started at the experimental station of the Institute of Oceanology, on the Black Sea, in 1953[6]. The first experiments were carried out in shallow water (up to 1.5-m. in depth), using quantities of treated sand not exceeding 2 to 5-kg. In the course of two summer seasons it was possible to select the types of dye and the binding media most suitable for practical purposes and to develop the simplest procedure for covering the grains with the colloidal film. The length of life of the fluorescent coating,

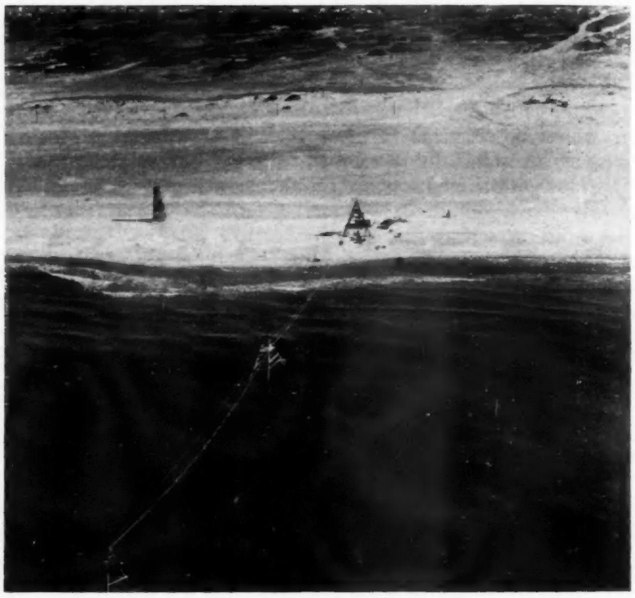

Fig. 1. Observation ropeway at Anapa.

both under water and on exposure to the air, was likewise determined. Finally, it was ascertained by means of laboratory experiments that the treatment in question does not alter the hydraulic properties of the sand.

At the present time two different fluorescent dyes are used, viz., anthracene and lumogene, in different colours (yellowish green and reddish orange). The former is a cheap substance, but it decomposes under the action of sunlight, and it has the further disadvantage that attacks the skin and mucous membranes. On the other hand, lumogene is entirely stable and harmless, though much more expensive[5].

The binding media used for forming the colloidal film are: agar, bone glue, gum and starch. Various mixtures of these substances may be employed; the most stable of these is a mixture of agar and bone glue which retains the dye under water for periods of three months and upwards. If a mixture of gum and starch is used, the dye disappears in about two weeks, and this period is further reduced if sugar is added.

The amount of fluorescent dye required for marking 100-kg. of sand varies from 0.1-kg. (anthracene) to 2-kg. (reddish orange lumogene). The amount depends not only on the properties of

the dye itself, but also on the size of the grains of sand to be treated and on their natural colour. Very fine sands and materials of dust-like fineness, which have large specific areas, require relatively larger amounts of dye. So do dark-coloured sands. The ideal sand for this method of investigation is quartz sand of medium fineness.

Fig. 2. Luminoscope.

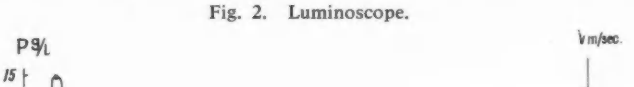

Diagram 1.

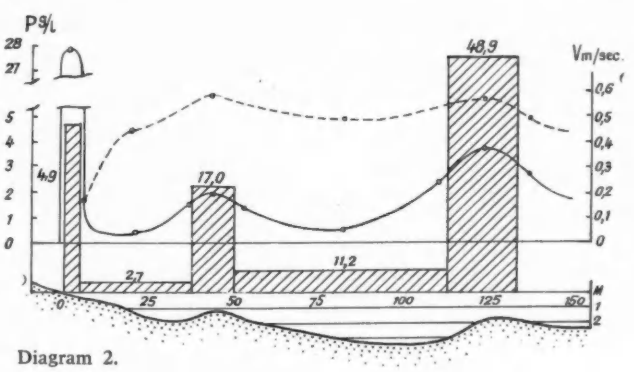

Diagram 2.

Fig. 3. Diagrams representing sand movement at varying distances from the shore.

The dye is thoroughly pulverised in a mortar and is thereupon mixed with the sand in a mixing drum (a petrol drum is used for the purpose, and the whole operation may be carried out on the beach). The simplest procedure is as follows. For treating 100-kg. of sand, 0.1-kg. of agar is dissolved in 10 litres of warm water; then cold water is added until a sufficient quantity of solution for wetting the sand is obtained (usually between 22 and 35 litres). The solution is then poured into the drum and is thoroughly mixed with the sand (at least 100 revolutions of the drum). The mixture is then removed from the drum and spread on a tarpaulin to dry. In wet weather a special dryer is used. The dried treated sand is stored in bags for at least 24 hours in order to ensure good adherence of the colloidal film.

Large-scale experiments were made in 1955[8]. For this purpose a ropeway 200-m. in length, running out into the sea, was constructed at Anapa, on the Black Sea. This structure is shown in Fig. 1. At a distance of 500-m. on either side of it, other special ropeway type installations were provided, which were used for dumping the batches of treated sand in rough weather: a skip containing treated sand could be run along the ropeway to the desired distance from the shore and automatically emptied. At different points along the observation ropeway, samples of sand for examination in the luminoscope were taken from the sea bed with the aid of a Petersen sampling device. The luminoscope was installed on the beach (Fig. 2). In the type of equipment illustrated, the ultraviolet rays for producing fluorescence of the treated sand are obtained from sunlight by passing it through an appropriate filter (the light enters the apparatus through the two windows visible in the photograph; the observer stands on the other side of the box, under a black cloth). This apparatus which relies on the sun for its source of ultraviolet light has an advantage over laboratory instruments equipped with an artificial ultraviolet source in that the fluorescence produced by it is much more brilliant.

In 1955 and 1956 a fairly large number of test series were carried out, in which samples of sand in quantities up to 150-kg. were taken simultaneously. The velocity of sand displacement caused by swell acting in a direction oblique to the coastline was found to be as high as 3-km/hour and was, on an average, equal to about three-quarters of the current velocity at the surface of the water. During the tests the various parameters affecting the conditions were determined, and observations of the direction of the swell and the current were made. In addition, various other measurements were made with the aid of the ropeway (bulk density of the sand, changes in the contours of the sea bed caused by gales, ground pressure exerted by the swell, etc.)[1, 7].

In spite of the high sand displacement velocities observed, the treated sand was found sometimes to remain for a fairly considerable time at the spot where it had been placed. This length of time depended on the characteristics of the transverse movements of the sand. At points where erosion or scour of the sea bed occurred the treated sand disappeared quite soon. On the other hand, it remained in its original place for several days in areas where the sea bed was comparatively stable. In some cases it was rapidly covered by layers of natural sand, but reappeared after a time, when the latter had been transported away by the movements of the water. The measurements made from the observation ropeway furthermore showed that the paths travelled by the grains of sand are, generally speaking, closely linked with the grain size (which on an average ranges from 0.125 to 0.250-mm.). A slower type of sand movement along the bottom was moreover found to occur, in which the grains describe zig-zag paths of large amplitude.

A number of submerged groyne-like structures were situated in the test zone, including two running at right angles to the observation ropeway. It was found that sand movement takes place only along the tops of these structures when a slight swell occurs. On the other hand, when there is a fairly heavy sea, the sand movement takes place along the bottom as well, but its amplitude is relatively small. On the basis of a large number of measurements made from the ropeway (current velocity, concentration of sand near the bottom, volume and duration of "turbidity clouds" at the tops of the waves, velocity of displacement of the sand), Aiboulatov was able to plot curves for the

intensity of the sand displacement in relation to the depth of the water, the distance from the shore, and the conformation of the sea bed. These curves (Fig. 3), which refer to two different weather conditions—characterised by wind force 2-3 (diagram I) and 4-5 (diagram II) respectively—are average curves derived from a large number of observations carried out under varying conditions of swell and current. The full lines in the diagrams represent the concentration of the sand in suspension (in grammes/litre: ordinates marked on the left-hand side), while the dotted lines represent the velocity of the current at the surface of the water (in m/sec.: ordinates marked on the right-hand side). Finally, the shaded rectangles represent the rate of transport of solids (in m^3/hour) at different points along the profile under investigation. The distances from the shore and the depths of water (in metres) are indicated in the lower part of each diagram.

While these tests were in progress at Anapa, the method using sand treated with a fluorescent dye as a tracer material was also used for investigating the occurrence of siltation at a Black Sea port. For this purpose, 500-kg. of treated sand was dumped in

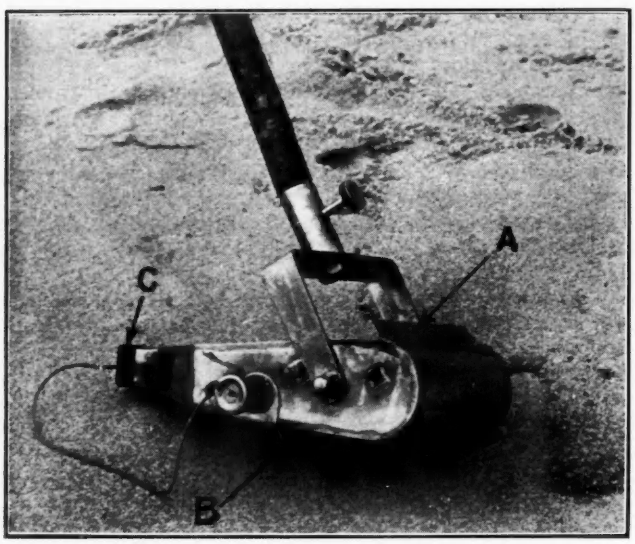

Fig. 4. Sand sampling device developed by the author.

the sea, and its movements were studied over a distance of more than 1-km. In this way it was possible to detect the arrival of the sand in the port area and to determine where its line of movement intersected the navigation channel[2]. The same investigators also carried out a test on a larger scale, using 2,000-kg. of treated sand, which was dumped in an area where erosion of the sea bed was suspected to be taking place. In the course of three summer months, during calm weather, the sand travelled a distance of over 3-km.

The experimental technique was subsequently improved and the range of experiments was widened. Observations confined to a single profile of the sea bed along the ropeway were not yielding enough information. The observations were therefore extended to cover a larger area. They were carried out in relatively calm weather (height of swell not exceeding 1-m.), and the samples of sand were collected by men wearing self-contained diving suits. In this way it was possible to study the movements of the sand in relation to the contours of the sea bed and the action of cross-currents.

Quantities of tracer sand dyed in different colours were deposited at various depths by the investigators, and the movements and intermingling that occurred were studied with reference to the depth of water. In other tests, the treated sand was classified into different grain sizes, each size being dyed a different colour. This procedure yielded interesting information on the movements of the sand in relation to the size of the grains. The results of these tests were still being analysed at the time of writing the present article.

Throughout these researches the investigators strove consistently to obtain data that were not only accurate but which were also mutually comparable. Initially the samples were taken with the aid of the Petersen device, as mentioned above; but the weight of the samples obtained by this means, and the thickness of the layer of sand scooped up by the device, tended to vary from one sampling operation to the next. The present author accordingly developed a simple apparatus for standardising the sampling procedure (Fig. 4). It functions more or less on the principle of a carpenter's plane and consists of a flat metal box provided with a transverse opening on its underside from which protrudes an inclined scraper blade. The length of the blade is normally 1-cm., i.e., removing a 1-cm. thick layer of sand from the bottom; the blade is detachable, however, and can be replaced by one of a different length. The blade is marked "B" in the photograph. The top of the box is provided with a vent hole (at "A") for the escape of air when it is lowered into the water. The sand collected in the box is subsequently removed through a rear opening provided with a rubber cap ("C"). The sampling device is dragged along the bottom by means of a long wooden handle to which it is connected by a pivoted joint. It can be used from a boat in depths of water up to 3-m. Each sample of sand (of at least 100-cm^3.) collected in this way is put in a numbered bag or jar. In due course the samples are examined in the luminoscope and the number of fluorescent grains per unit area (e.g., per dm^2) counted.

Sand treated with fluorescent compounds has already found extensive use in the Soviet Union as a tracer material. The Ministry of the Mercantile Marine has used it for studying the silting of ports and navigation channels in the Caspian Sea, the Black Sea and the Baltic Sea, with satisfactory results[9]. A special training course for investigators wishing to use this technique has been established jointly by the Institute of Oceanology and the Institute of the Ministry of the Mercantile Marine.

Successful investigations of coastal erosion and build-up have also been carried out in the Sea of Ochotsk, despite the rather unfavourable properties of the sand from the point of view of this method (very fine, dark-coloured grains)[4]. Fluorescent substances are also being used for studying the behaviour of the banks of artificial reservoirs[3]. They are moreover employed in connection with model tests in hydraulic laboratories.

During the summer of 1957 the present author and V. Boldyrev conducted researches into the deposition of sand brought about by the construction of groynes along a 0.5-km. stretch of coastline in Poland. The tests were carried out under difficult conditions, in cold weather and heavy swell (2.5-m. amplitude), which made it impossible to build an observation ropeway or similar installation. In all cases the investigators had to wear diving suits for collecting the samples of sand. Various methods were used for placing the fluorescent tracer sand on the sea bed. In most cases it was carried to the ends of the groynes and dumped into the water in quantities of 200-kg. The diver entrusted with the task of obtaining samples of sand often had to enter the sea in very rough weather, holding on to a rope running from the shore to a buoy anchored out at sea. Satisfactory results were obtained despite the difficulties. It was found that in periods of light swell the sand is transported freely along the coast; in rough weather, however, it is for the most part stopped by the groynes, which thus greatly reduce the rate of sand transport. These investigations were continued in 1958.

Bibliography appears at foot of following page.

A Review of Dock Labour

Report on Investigation at Several European Ports

By I. C. Millissis and D. Tzamaloukas

A REPORT on the Organisation, Operation and Installations at certain European ports was prepared in June last, jointly by two officials of the Port of Piraeus Authority—Mr. I. C. Millissis, Chief of the Operations Division, and Mr. D. Tzamaloukas, Manager of Port Construction Works—who were granted a Fellowship of the United Nations, Technical Aid, in order that they could go abroad and study subjects related to the administration and organisation of ports. In Great Britain they visited London, Liverpool, Southampton, Cardiff, Newport and Port Talbot; on the Continent, Copenhagen, Stockholm, Gothenburg, Amsterdam, Rotterdam and Genoa.

The Report includes sections headed (i) Certain generalisations about ports; (ii) General description of each of the ports visited; (iii) Different types of port administration (with the authors' opinion upon the "extent of competence" of each); (iv) The organisation of port services; (v) Labour problems in the ports; (vi) The mechanisation of loading and unloading work; (vii) Port finances; (viii) Port accounts offices and (ix) Port works. Each separate subject is dealt with comprehensively. That on port work, for example, includes 27 drawings of new installations seen in several of the ports visited.

One of the most interesting sections is that on labour problems. The authors have sub-divided this section as follows: (a) The labour problems of ports; (b) The way it has been solved in the United Kingdom and (c) The way it has been solved at some Continental ports. Abstracts from this section of the report are printed below. Some of the matter in it is common knowledge but its particular value is that it is the result of an unbiased probe by two port officials approaching a useful field of enquiry with open minds.

(a) The Labour Problem of Ports

The labour problem which is faced by all large ports has a double form. Due to the peculiar type of the work it is, on the one hand, a problem of allocating thousands of workmen within a few minutes, and on the other, a problem of attracting able workmen who after being trained are to work permanently, notwithstanding the fact that they may not continuously be allocated work, due to another peculiarity of the work in ports.

Industry workers are generally permanently allocated to their work, and this suits the interests of the industrial enterprise itself for the specialisation of their workmen. A natural consequence of this fact is that in industries it is not necessary to organise the distribution of labour manpower, and each workman proceeds to a regular machine. In this way time, as well as "organisation" is gained. The number of such workmen whose kind and place of work often change is small.

On the other hand, especially in the Transport Industry, there are many cases where it is necessary continuously, and sometimes even daily, to readjust the work and redistribute the workmen. The work of loading and unloading ships is the point where this difficulty of redistribution of work and workmen reaches its climax. In loading and unloading nothing can be definitely preplanned. There is, of course, information available from advices sent prior to ships' arrival, as well as information regarding the cargo and its stowage in the ships' holds. Such information, however, does not give sure and responsible details of the exact time of a ship's arrival, nor does it necessarily determine the berth at which the unloading and loading will be affected.

The day and hour of ships' arrival, particularly where general cargo vessels are concerned, depend on many factors, some of which cannot always be decided beforehand.

The speed and way in which loading and unloading were effected at the previous port of call, the possibility of continuation of work during the night, a storm at sea, snow, fog, excessive heat during the day in connection with the unloading of cold stores, an insufficient number of dock workers or machines or tools or floating craft, the arrival of cargo for loading at the last moment, all these give a general idea of the difficulties, which render it impossible for anyone to know in advance when the cargo ship will start unloading.

Also, it is often difficult to determine in advance where the ship will unload, that is at which precise quay, shed or open area. This often depends on whether the cargo consignee or the shipowners have their own port site areas for collection of the goods, or whether they must look for areas elsewhere or if and where there are suitable machines or floating craft, or whether the ship previously unloading on the fixed point finished its work in good time.

Also of importance is the kind of cargo, the method of stowage in the ship's holds, whether by any chance with the ordinary cargo there is also a cargo of explosives or inflammable goods, and the conditions and way in which these dangerous goods are unloaded in each port.

For these reasons, in port work it is not possible for one to know exactly, not even on the previous evening, how many ships will arrive and what cargo will be unloaded next day. Until the actual time of the roll-call, fresh work is added and other work already scheduled is cancelled at the last minute.

The great difficulty, therefore, in the allocation of labour for port work lies in the fact that their allocation programme, as well as that for machines and other gear, is scheduled at very

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short notice; that is to say, instead of the workmen, as in other industries, proceeding direct to the place of their work, in the port industry there is a need for daily redistribution of the total labour manpower. Every morning all the dockers must be allocated anew to other ships, to other warehouses, for another kind of cargo, to handle different machines and with different gear. At the same time, and as a natural consequence of such redistribution, the same applies to all machines, to checkers, to tugboats and their crews, lighters and lightermen, watchmen, tractors and cars and their drivers, and to almost all those working in the port.

This important problem is very interesting and the way it is faced in various ports is worthy of study.

As a general principle, in all the large ports labour allocation is not effected from a single central point, but is divided into several distribution offices. This also applies to our own port (Piraeus) where labourers are allocated by local departments.

A fact that facilitates labour allocation in the ports which we visited, is that in almost all of them there are workmen permanently available to private contractors, who do not answer the daily roll-call but report directly to their employers. Another factor which applies to most foreign ports and does not apply to Piraeus, is that employers there are able to select their own workmen. In this way, each employer informs in advance his preferred workmen, who, also do not have to answer the roll-call.

These two basic principles which apply to all ports, greatly facilitate work distribution and limit the number of workmen who answer the roll-call and are allocated work by the Labour Disposal Office. In effect the local Labour Disposal Offices only hire men for work which has been schduled at the last minute, or workmen who for any reason are not disposed for work.

It is easy to understand the advantages of free selection of workmen by the employers. Firstly, workmen are induced to work. Good workmen, being competed for, are never idle awaiting work. Also, by the selection of workmen by employers, the speedy allocation of labour is greatly facilitated, in view of the fact that the number of personnel distributed through the Labour Disposal Office is considerably reduced.

However, in spite of the above-mentioned undisputed advantages of the free selection of labour by employers, we fear that this would not apply to our own port, for the only employer of the whole port labour is the O.L.P. (Port of Piraeus Authority), and this Authority must, therefore, select and distribute its workmen, which in fact it does.

Until the beginning of the present century there was no difficulty in finding labour to effect loading and unloading of ships. Ships were small and hatch work which demanded a certain skill was, as a rule, carried out by their crews.

Where the cargo was more than the crew could handle and they had therefore to be reinforced by workmen for loading and unloading, the usual unskilled labour which exists at all ports in the world was hired and formed into labour gangs, headed by the ship-master or other members of the ship's crew who handled the ship's winches.

No skill was required. Crews performed "Boss" duties, handled the winches and gave instructions to the unskilled labour, when and where required. Goods were transported well and securely packed in oak barrels, strong wooden cases and strong bags, so that it was not necessary to pay special attention to their handling.

The situation began to change during the present century, when bulk cargoes began to increase substantially, which require special gear and machinery for their unloading, and consequently, specialised personnel also. At the same time, the size of ships increased and also, of course, the amount of cargo carried, whilst the ship's crew decreased in number and, consequently, the augmenting of unskilled labour by crew members, in order to handle winches etc. became impossible.

Crews confined themselves, in the beginning, to the opening of ship's holds (a difficult and dangerous work) and to preparing the ship's winch (a responsible job) but soon, even for this work there was not a sufficient number of the crew available and so these operations began to be taken over by port workmen, who had experience of handling, not only winches, but also other equipment which was beginning to appear. The use, therefore, of free unskilled labour in large ports ceased, and a preference for skilled dockers was clearly manifested, as these had the technical knowledge necessary to their profession.

Port work, however, is not continuous. Sometimes there is a glut of work and a great number of labourers are required, and at other times there are long slack periods when skilled workers remain idle. Therefore, those who were able, preferred other jobs where their work would be continuous so that they could make a steady living, or they ended in demanding greater remuneration during the work days, so that they could have a surplus income for the days of compulsory idleness. Port workmen were then organised in Labour Unions and began to offer their services only through these.

Therefore in one way or another, all ports were compelled to regulate the question of enlisting suitable skilled labour for stevedoring work, and all solutions tried, although they seem different to a layman's eyes, were in fact related, for they were an attempt to solve basically the same problem.

A complete solution has not yet been found, however, to the problem of providing skilled personnel to whom permanent work can be assured.

As already stated, ports present maximum and minimum limits of employment. If therefore, they are compelled to keep a permanent labour force they would then be obliged to pay a remuneration even for the period during which the men would not be working. If, on the other hand they limit the number of permanent workmen then it would be necessary to complete their labour manpower with unskilled workmen, if and when these were available.

All the ports visited by us, as well as all the ports we know of, have solved their problem on the same general lines. All have a permanent labour manpower of dockers, who receive remuneration when there is no work, and all ports augment this force with other workmen, when the necessity arises for an increased number of hands.

(b) **Solution in The United Kingdom**

British ports have solved this problem on a national scale.

During the Second World War the necessity arose for military reasons, to have workmen transferred from port to port according to strategic needs. A temporary large union of all the dockers in England was formed and 50 per cent of the regular daily wages were assured to each worker during idle days, whilst the dockers undertook to serve at any port.

During 1947, by a British Act of Parliament, this temporary war-time arrangement was confirmed and the National Dock Labour Board was constituted. This is an organisation covering the employment of all the dockers in Great Britain, which undertakes as a monopoly, to supply dockers to all English ports, whether they be autonomous or public or privately owned, and to collect their dues directly from their employers increased by some percentage to meet social security, annual leave and unemployment assurance for their workmen, and to pay them weekly according to the work done by each. Furthermore, beyond this large organisation for the supply of labour, Great Britain also established Mixed Arbitration Committees for the solution of differences between workmen and employers. These Committees

comprise an equal number of employers and union officials and their decisions are obligatory for both parties.

In this way, the relatively acute situation which formerly prevailed between workmen and employers in the British ports, improved without, however, strikes being completely stopped. The strange fact is that since Mixed Arbitration Committees' decisions are obligatory for both parties, the Unions are obliged to agree with the committees' conclusions, but workmen still strike unofficially, despite their Unions' instructions to the contrary. Nevertheless the National Dock Labour Board has evolved an original system for solving the dockers' problem for the whole country, and for this reason we deem it advisable to give below more details concerning its scope.

National Dock Labour Board

The N.D.L.B. is administered by a Council of 10 members. Four of its members are employers' representatives, four workmen's representatives and two, the President and Vice-president, are nominated by the Government.

At the end of December 1957, a total of 76,691 dockers were registered divided into the 25 local branches. At London 30,273 dockers were registered and 16,532 dockers at Liverpool.

The following advantages are assured to registered dockers.

(1) Minimum daily wages: subject to the docker's attendance at eleven roll-calls in the week, which take place at 8.00 a.m. and 1.00 p.m. on the five working days, and only at 8.00 a.m. on Saturday which is considered as half working day.

For every attendance a sum, varying from port to port and according to the workman's category, is paid to the dockers when they are not employed.

In London, for ordinary dockers under 60 years of age, the assured minimum remuneration is 6s. per attendance. As during weekdays there are two roll-calls, this means that the minimum guaranteed remuneration amounts to 12s. The regular daily wages for London area is £1 13s. 4d.

(2) Minimum weekly wages: subject to attendance at all roll-calls in the week. For London ordinary dockers, under 60 years of age, this sum is £6 1s.

Naturally this sum includes not only the guaranteed minimum daily remuneration in case there is no work, but also whatever dockers have earned during that week from any work they have done.

(3) Grant of leave with pay.

(4) Disciplinary procedure: by mixed Administrative Tribunals, in which participate, in equal numbers, dockers and employers.

In addition to the above the N.D.L.B. is responsible for the social welfare of dockers by providing them with clubs, educational centres, medical facilities, canteens etc. All dockers, including crane drivers and handlers of other loading and unloading gear, and checkers must be registered by the N.D.L.B. They are divided in two large categories:

(a) the dockers who work permanently with a definite employer on weekly wages;

(b) the dockers who are hired daily by various employers at the call stands of the N.D.L.B.

Those who have been hired permanently by private employers are paid directly by their employers, who also pay into the N.D.L.B. for its general expenses, and medical care a percentage of the weekly wages paid to their workmen.

Employers have the right to select the workmen and only those not selected register their attendance and obtain the guaranteed minimum daily wages. A clever system of stamps on the special booklets of dockers permits a complete and quick checking of where the docker has worked or if he remained idle awaiting for work. Employers are obliged to send in, every week, to the offices of the local N.D.L.B. a chart showing the dockers who were employed by them on daily wages during the week, the sum to which each one is entitled, together with a cheque in payment of this sum plus a percentage to cover N.D.L.B. expenses as mentioned above.

(c) The Labour Problem of Continental Ports

The problem of assuring continuous work to the dockers of Continental ports was solved in a way similar to the English method, the only difference being that the assurance of work and allowances, in cases where such assurance did not exist, was not regulated by the State and on a national scale, but by the local private employers themselves who established a sort of compulsory co-operative society in each port, in order to solve the problem locally. In this way in Hamburg, the "Port General Company" (Gesamthafenbetrieb) was established, in Rotterdam the "Rotterdam Dockers' Union" (S.V.Z.) and in Amsterdam the "Port Co-operative Enterprises Institute" (S.H.B.).

The above-mentioned organisations are insurance enterprises of dockers which collect the required sums for this social purpose, by charging them on to invoices issued for loading and landing expenses, with an extra charge of a percentage varying according to the port and to the insurance cover. All these organisations have the common feature that they were formed by private agreement between the labour and the employers' Unions established for this purpose. In the meaning "employer" is included anyone who uses loading and unloading workmen, crane drivers and checkers in the port, irrespective of whether it is a ship-owner company or stevedoring contractor or warehouse company or the port authority. These insurance authorities collect the requisite moneys in order to assure the workmen a sum of money during their idle days, which sum, however, is in any case less than the regular simple daily wages. They also dispose of funds for granting leave with pay to the dockers, for extra allowances for accidents and sickness, and the supply of some kind of pension.

Here again the dockers are divided into two categories; those who work permanently with certain employers, and those who are directly allocated by the Authority to the employers auxiliary, during the days they require reinforcement in labour manpower. Naturally, payment of six daily wages is assured to the first workmen, whilst to the others, mostly called extra or auxiliary labour, the assurance is less.

By comparing the solution given in Great Britain to the problem of assurance of the port labour manpower, with the solution given in the three large Continental ports, which we visited, we find that the English solution has certain advantages for the following reasons:

> Workmen are more secure because the State has undertaken and guaranteed their wages and assurances.
>
> Should the cargo traffic at Continental ports decrease, it would be impossible for private employers to carry the weight of the idle dockers so that, necessarily, it would be impossible for the theoretically promised assurance, to be fulfilled in actual fact.

A point to which great importance is given at some Continental ports, and especially the ports of Amsterdam and Rotterdam, and, as we are informed, Antwerp also, is the dockers' education. The subject is faced in these ports as it actually exists, and the given solution, especially in Rotterdam, is one which could well be adopted in all the ports of the world.

The docker has ceased to be an unskilled labourer and, today, he is perhaps the most skilled of industrial workmen. He must have nautical knowledge, be an able handler of machinery, and know the stowage and shifting of cargo.

When the manpower of skilled dockers is exhausted in our small ports in Greece and we have to recourse to the hiring of casual unskilled labour, the decrease of out-turn, the increase of labour accidents, and the damage caused to the goods are so apparent, that even we ourselves often wonder how there are ships that are willing to be worked by casual labour, in spite of the fact that we supply them, in any case, with experienced foremen and cranemen. Therefore, the establishment of special schools in which dockers or anyone wishing, can learn the heavy and difficult duties of a dockworker is a real need. It is about time dockers' education ceased being carried out at the expense of the goods and of the ships.

We visited the special school which functions in Rotterdam, where young apprentices attend a three-year training course and we observed how comprehensive is the school's programme and how many things we ourselves have to learn, who have had more than 30 years' experience in this type of work.

The school's influence is felt not only as regards the technical fitting out of its graduates, but contributes also to the raising of the docker's social and professional standard. School attendance has also a favourable effect on discipline.

In Scandinavian ports the problem of assuring the supply of work has been solved in a different way.

Thus, in Sweden there is the "Dockers' Disposal Office," subordinated to the Swedish Ministry of Labour, which assures the dockers against unemployment. In Göteborg, however, the "Incorporated Company of the free port of Göteborg" employs permanent workmen to whom the Company pays their wages, regardless of existence or non-existence of work. The same happens in Copenhagen, where daily wages are assured to the workmen of the "Incorporated Company of the Port of Copenhagen," whether work is available or not.

It would, however, be useless to compare in any way the assurances which the dockers enjoy in Scandinavia, with those in force in our own country, because the General Social Assurances system existing in these countries greatly differs from our own.

Finally, in Genoa a system of self-assurance is in force. That is to say, the Co-operative bodies which directly collect their dues and also a percentage for assurance against lack of work, leave, bonuses etc. pay out of this capital a reduced daily wage to the workmen when there is no work available for them.

The Port of Genoa administrators have long known of the necessity to incorporate labour into a "Consortium," insured by a Italian Public guarantee. In spite of all their efforts however, they have not managed to change the existing state of affairs because they are up against the organised interests of the labour Co-operative Unions' administrators.

The conclusion from the above is:

1. That in order to ensure a good standard of living dockers must be assured that daily wages will be paid to them, even when there is not enough work.

2. That these assured wages should be substantially lower than the regular work wages, so that dockers are induced to work, and do not reach a point where laziness is rewarded and encouraged.

In our port, work supply is assured to the permanent workmen by the Port of Piraeus Authority. This however, is on a strictly local scale, and therefore depends on the prosperity of the port.

The assurance percentage is excessive and reaches 100% of the daily wages. It is not organised in a rational way, so that it only assures daily wages and we arrive at the strange situation where a worker who has worked the whole of the night and has enjoyed 4 or 5 daily wages, is entitled on the next day to full assured daily wages for not being disposed to work.

As regards Thessaloniki (Salonica) and the other Greek provincial ports, the situation is even worse, because the dockers' co-operative unions divid their weekly income between themselves and usually in equal parts, thus encouraging the avoidance of work, but also not assuring their workmen for the periods of unemployment.

New Dredge for Port Taranaki

Modern Vessel with Varied Equipment*

By P. D. L. HOLMES, A.M.I.C.E., A.M.N.Z.I.E.
(Chief Engineer, Taranaki Harbour Board)

The annual dredging programme for Port Taranaki, New Zealand, requires the removal, from fairways and berths, of some 200,000 tons of sand and 40,000 tons of mud. It is also proposed to carry out new dredging in conglomerate, broken by blasting, and the amount to be removed is about 40,000 to 50,000 ton annually. An investigation was made by the consulting engineers, Sir Bruce White, Wolfe Barry and Partners of London, and a steam propelled hopper dredge with trailing suction equipment and a grabbing crane was selected as the most suitable type. A detailed specification was drawn up and world-wide tenders called, that of Fleming and Ferguson Ltd., Paisley, Scotland, being accepted.

Description

"Ngamotu" is an oil-fired steam twin-screw hopper dredge, fitted with an 8-ton grabbing crane, dredge pump, and trailing suction gear which may be alternatively operated as a forward-facing suction pipe. Trail suction dredging is controlled entirely from the bridge; a Voith Schneider propeller is fitted in the bows to assist maintaining course when trail dredging.

The dimensions of the vessel are:

- Length overall—201-ft.
- Breadth—40-ft.
- Depth moulded—14-ft. 6-in.
- Registered tonnage—923 tons.
- Displacement, loaded—1,930 tons.
- Hopper capacity—800 tons.
- Dredging depth—suction 45-ft.
- Dredging depth—grab 50-ft.
- Suction pipe diameter—18-in.
- Crane capacity—(Priestman 80)—8 tons.
- Main engines—2 triple-expansion—each of 230 i.h.p.
- Pump engine—1 triple-expansion of 315 i.h.p.
- Voith Schneider propeller—8E.

Performance on trial:

- Loading with dredge pump in mud 10 min. 32 sec. obtaining 800 tons mud and water—400 tons solids from a depth of 45-ft.
- Loading with grabbing crane from a depth of 50-ft.—765 tons of mud (solids) in 2 hours.
- Service speed loaded (max.) 9½ knots.

An elevational layout of the vessel is shown in Fig. 1.

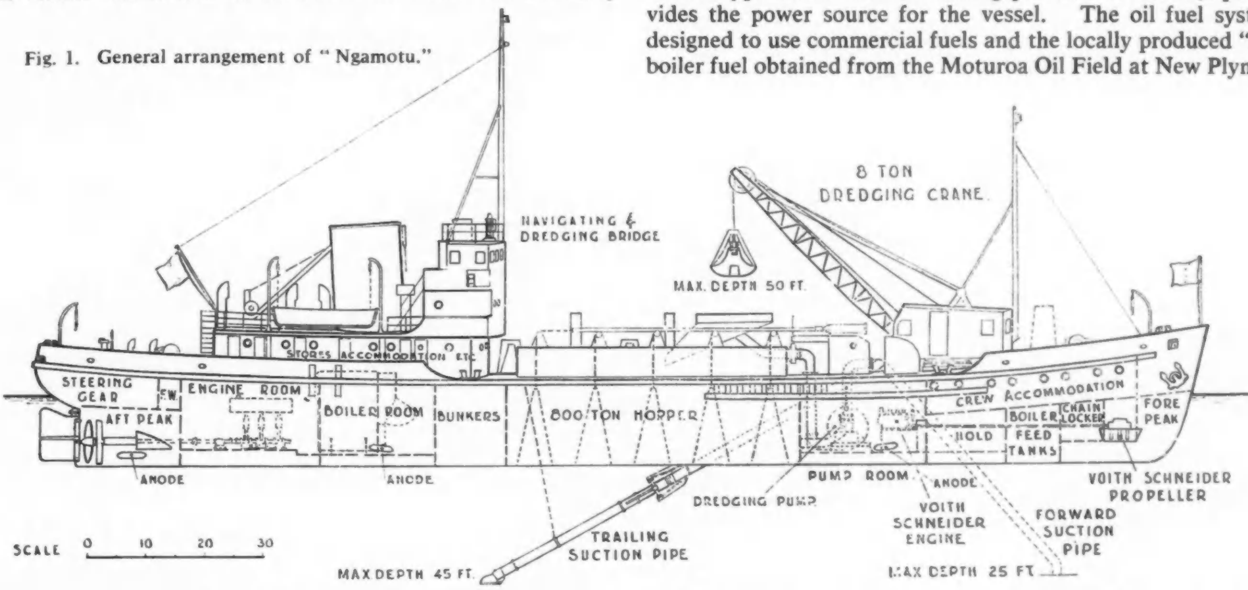
Voith Schneider Propeller

When using the drag arm (or trail suction) equipment, which is fitted on the port side only, dredging is carried out at extremely

*Abstracts from article in the September 1959 issue of N.Z. Engineering.

low speeds (1½ to 2 knots) over the ground and steering at these speeds becomes extremely sluggish. Since the dredging ground is exposed in part to high winds and swell, and these conditions would have the effect of causing the bows to "fall off" with the consequent risk of the hull overriding the suction pipe trailing alongside, a means was sought which would give positive control of the vessel. Some form of control in the bows was obviously necessary to keep them up into the weather. A bow rudder was considered but was entirely unsuitable for the type of vessel and too likely to suffer damage. The final choice was for a Voith Schneider (V.S.) propeller fitted in an athwartship tunnel across the bows as this would give positive thrust and would be of great assistance when manœuvring in confined spaces between wharves. V.S. propellers are coming into fairly general use for specialised harbour and coastal craft as main propulsion. German mine-sweepers used them extensively during the last war. As far as the writer has been able to determine "Ngamotu" is the first vessel to use the bow control propeller and several other craft are proposed which will use the same arrangement. The method of operation is shown in Fig. 2. This is the first V.S. propeller to come into use in New Zealand and is perhaps the most interesting feature in "Ngamotu." The standard V.S. propeller has several blades not unlike single aeroplane propeller blades arranged vertically downwards near the circumference of a horizontal boss which rotates at constant speed. The blades are so arranged that by internal cranks they can be trimmed and feathered in such a manner that thrust is obtained in the desired direction by means of a remote control. The degree of thrust is controlled by a coarseness of the trim applied to the blades. Fig. 2 shows a plan arrangement of the blades and cranks.

Fig. 1. General arrangement of "Ngamotu."



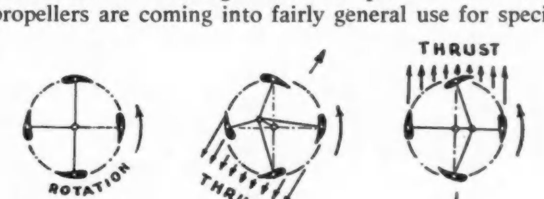


Fig. 2. Principle of V.S. propeller.

The arrangement in "Ngamotu" requires varying thrusts transversely only and the propeller, which is driven by a constant speed diesel engine in the pump room, is controlled hydraulically from a single bridge pedestal giving both varying thrust and direction. Fig. 3 shows, diagrammatically, the effect of this control.

Machinery

An oil-fired single-ended cylindrical return tube multi-tubular marine-type boiler with a working pressure of 220 lb/sq.in. provides the power source for the vessel. The oil fuel system is designed to use commercial fuels and the locally produced "Peak" boiler fuel obtained from the Moturoa Oil Field at New Plymouth. This is a residual product from the distillation of local crude oil and it freezes at about 87°F. The "Peak" bunker is, therefore, heated and all fuel lines are heated as well to prevent freezing. Another precaution taken is to flush out all the fuel lines before shutting down the fires.

The main engines are situated aft: they are a pair of triple-expansion open-type engines of 230 i.h.p. each direct-coupled to the 4-blade manganese bronze propellers. All feed, air, sanitary, and fresh-water general-service pumps are situated in the engine room. The main generator of 120-kW is steam driven; the auxiliary generator of 25-kW. is diesel driven. The main switch-board and the shore power rectifier are also situated in the engine room; 220-v. D.C. is used throughout. Forward of the hopper in the pump room are situated the dredge pump and engine (identical with the main engines except that it has no reversing gear). The pump room also contains the diesel engine for the V.S. propeller, a diesel-driven emergency fire pump, electric pump for the hydraulic system, gland pump for sealing glands in the dredging equipment against ingress of grit, and the contactor panels for the electric dredging winches.

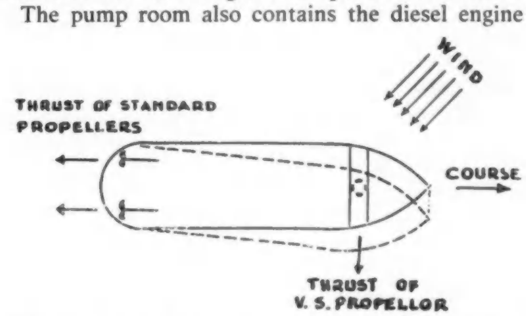


Fig. 3. Control of "Ngamotu" with bow V.S. propeller.

A heavy-duty winch-windlass and winch are fitted on the main deck at bow and stern. They are each fitted with rope barrels carrying 90 fathoms of 3½-in. wire rope used for dredging anchors.

Dredging Equipment

A Priestman size 80 steam dredging crane is mounted forward. This crane has an 8-ton capacity at 36-ft. radius and handles its grabs on the four-rope system, that is two hoisting and two closing ropes. Four grabs were purchased to cope with different conditions. They are: 95/78 cu. ft. mud grab; 70/56 cu. ft. sand grab; 55/44 cu. ft. whole tine rock grab, and a rock grapple (cactus) grab. The rock grapple has eight jaws for handling boulders.

Steam from the main boiler is supplied to the crane through the king pin which also carries the exhaust steam and electrical circuits. A special feature was made of the locking arrangements for the crane. These are in the form of heavy locking bars at the corners of the superstructure which engage in pedestals on the deck and this has proved a very satisfactory arrangement.

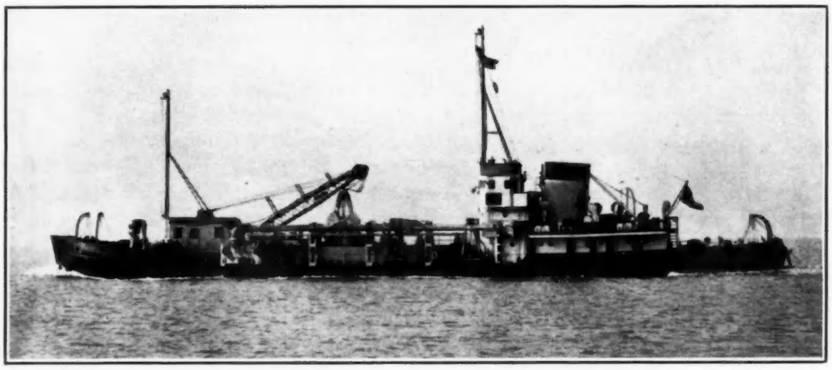


Fig. 4. The T.S. Hopper Dredger "Ngamotu" with suction-dredging pipe in stowed position.

The suction-dredging pipe is fitted on the port side only and is arranged to be fitted in a forward-facing or trailing position. In the former it is used for stationary suction work in deep sand with the dredge on moorings, and in the latter for trail dredging with the vessel under way and the end of the pipe dragging along the bottom. In the trailing arrangement, the pipe is in two sections with a flexible rubber joint in the centre carried in a heavy gimbal. The lower end of the pipe is fitted with a sledge type of nozzle through which is drawn the spoil.

The pipe is suspended by two wires from cranes or davits to the gimbal ring and the lower end near the nozzle; the upper end of the pipe terminates in a heavy elbow with a rotating joint attached to the deck and leading to the dredging pump. The two hoist wires are led to a two-drum 24 h.p. electric winch, the after, or lower, end wire being passed over a hydraulic compensator en route to reduce shocks and maintain tension on the wire. The whole arrangement can be hoisted inboard clear of the ship's side, and the photograph of the vessel (Fig. 4) shows the pipe in the stowed position. The pipe-winch master controller is situated on the bridge and the contactor panel in the pump room. Three different nozzles are used with the suction pipe. For trailing work a sledge-like self-adjusting type is used for regular work, and for dredging side slopes a "Newport Bay" head, somewhat like a large pipe elbow, is used. For the pipe in the forward position a simple foalsfoot head is used. The materials which can be handled are mud, sand, and gravel.

Surplus water in the hopper before dredging commences is an embarrassment, particularly when handling slow-settling materials such as mud. The hopper doors are fitted with rubbers to effect a tight seal and a suction from the dredge pump is led to the bottom of the hopper. Discharge on the delivery side of the pump may be either overboard or to the hopper, so that only spoil mixtures are discharged into the hopper. The four valves controlling suctions and discharges are hydraulically operated from the bridge.

The 800-ton spoil hopper has vertical sides to aid speedy dumping through the 10 pairs of bottom doors. The doors are coupled in five pairs to each of two single-acting hydraulic rams controlled from the bridge for closing the doors. Heavy steel keys secure each pair when closed.

Navigating and Control Bridge

The bridge is situated aft of the hopper, completely enclosed and carried the full width of the ship. It serves as both the navigating and the dredging bridge which makes for close control of the whole operation.

Navigating controls include three sets of engine room telegraphs, main engine revolution indicators, projector-type compass, Voith Schneider wheel, and standard wheel of the hydraulic telemotor type. Other fittings include radio-telephone, echo sounder, loud hailer, Kent clear-view screens and telephones to engine room and pump room.

The dredging controls are situated on the port side and they are a pipe-hoist controller, hopper-door ram controls, hydraulic-valve controls, dredging-depth indicator, pump vacuum gauge, and a "telltale" board indicating the position of all hydraulic gear.

General

The basic cost of the vessel was £460,000 and together with spares, delivery cost etc. the total is a little over £500,000.

Very good outputs have been obtained. With the grabbing crane using the sand grab, 1,600 tons is readily dredged, and while using the suction equipment 4,800 tons has been attained, in an 8 hour day. The material is dumped at sea and the run to the dumping ground is about 1½ miles. The average cost is estimated to be between 3s. 8d. and 4s. 2d. per cubic yard of material dredged. These costs are for sand and mud dredging and are expected to be higher when handling conglomerate which may require blasting and will be slower getting.

"Ngamotu" is an unusual dredge, fitted to handle widely differing material. She has been designed to give high efficiency on her major work requirement and to be capable of carrying out port improvements on a long-term basis. The scope of the work precluded two types of dredge being used and the variety of the work demanded the combination of equipment.

Litigation in the Port Industry

Safeguarding Means of Access

By LAURENCE WEBLEY, LL.B.

Two recent accident cases in the docks resulting from comparatively trivial omissions illustrate very well the comprehensive effect of the Docks Regulations on safety as well as the differing responsibilities of dock users. Both cases concerned ladders.

In the first case, Wingfield v. Ellerman's Wilson Line Ltd. (Furley and Co. Ltd., third parties), the ladder slipped. Wingfield, the plaintiff, a dock worker employed at Hull, was going down a ladder from the quayside to the lighter "Noe" when the ladder fell and he was thrown to the deck and injured. At the time of the accident, cases of tomatoes were being unloaded from the defendants' ship in the Alexander Dock into the lighter which

was owned by Furley and Co. Ltd., the third parties. The lighter was lying alongside the quay and the ship under the flare of her bow. Two half gangs were working on the tomatoes. The gang to which the plaintiff did not belong, went to work in the lighter first. They asked the master or mate of the lighter to put up a ladder which they used to go on board from the quay. The ladder was about 8-ft. long and was normally used for going into the lighter's hold. On this particular day, because of the exceptionally low level of the water in the dock, the ladder could only reach the quayside by being placed on the covers of the foreward hatch which curved from a height of about 2-ft. above the deck at the coamings to 3-ft. in the middle. It had been snowing that morning and, in consequence, the foot of the ladder was resting in snow and possibly on ice. It was also alleged that the hatch cover itself was not fastened down on to the coamings but rested unevenly on the cargo in the hold. However, the first half gang negotiated the ladder without accident. Some time later the second half gang, which included Wingfield, started to go into the lighter. When he was on the ladder it slipped and he fell, scraping his face against the quay wall and being thrown heavily to the deck. In consequence he received an injury to his face and a serious injury to his eye. He sued his employers, Ellerman's Wilson Line, alleging negligence and a breach of Regulations 9 and 50 of the Docks Regulations. Regulation 9 states " that where a ship is lying at a wharf or quay for the purpose of loading or unloading there must be safe means of access for the persons employed. This is specified to mean, where reasonably practicable, the ship's gangway or accommodation ladder, which must be not less than 22-in. wide and properly secured and fenced, or, alternatively, a ladder of sound construction and adequate length, properly secured to prevent slipping. Regulation 50 declares that if the persons whose duty it is fail to do this then the employers of the persons for whom the means of access are needed must do so.

Clearly in the circumstances it was difficult to deny that the access had failed to comply with the Regulations. The employers, however, brought in the owners of the " Noe " as third parties saying the accident was caused by their breach, or the breach by the master or officer in charge of the lighter, of Regulation 9. They declared the ladder was a trap or an unusual danger which the third parties should have known about and remedied; or they should have warned the plaintiff as an invitee in their ship. They, therefore, claimed a contribution from the third parties who denied that they were liable or that the Regulations applied to their lighter.

Giving judgment his Lordship said that on the morning of the accident the water in the dock was considerably lower than usual. It was rare for the distance from the lighter's deck to the top of the quay to be too great to prevent the ladder being securely footed against the hatch coamings or the wheelhouse as was the normal practice. On this occasion, however, the ladder was too short if footed on the deck. It was, accordingly, placed on the top of the hatch covers from whence it just reached the top of the quay. The evidence showed that when dock workers' needed access to lighters lying alongside the quays they used the lighter's ladders. After referring to the conditions at the time his Lordship went on to say that the defendants had declared that they were entitled to rely on the access invariably provided by the lighter as being safe. Doubtless, if they had no notice to the contrary there would be no breach of duty to their employees in making that assumption. But here, it seemed to him, they had the clearest possible notice that the usual means of access was dangerous. Their foreman knew the length of the ladder and should have realized that the ladder might slip. The defendants had fallen short in their duty as reasonable employers to provide, or to see their employees were provided, with a reasonably safe means of access.

On the question of contributory negligence his Lordship added that the obviousness of the danger should also have been apparent to the plaintiff, although it was true that other workmen had just used the ladder safely. Nevertheless, he estimated that Wingfield was 50% to blame for the accident. Wingfield was, therefore, awarded one half of the general and special damages assessed i.e. £720.

After hearing argument in the third party proceedings his Lordship said that, so far as they were concerned, Wingfield was an invitee. They did not owe him the kind of duty owed by his employers. Their duty was merely to warn him of dangers about which he did not know. Here the danger was obvious. His Lordship did not think that the plaintiff himself could have recovered anything from the third parties and, therefore, the claim against them for a contribution failed. Apparently it was not considered that the Docks Regulations applied in their case. This was, of course, merely a claim for contribution.

The foregoing aptly illustrates the serious financial consequences which may result from a trivial omission ; also the widely differing responsibilities of dock users to dock workers. It is clear that dock employers cannot evade responsibility for the conditions in ships where their men work, particularly where they have notice of danger.

Access from a Ship's Hold

The question of access from a ship's hold was the matter considered in Wilkins v. William Cory and Son Ltd. Wilkins was working as a coal trimmer in the defendant's ship, the " Corglen." When climbing a ladder from the hold on to the deck, he struck his head against a beam or girder protruding across the top of the hold. After this accident he continued working but, about a year later, he suffered a further disability and sued Cory and Sons claiming his condition resulted from this accident and alleging a breach of Regulation 11 of the Docks Regulations.

This provides for safe means of access to holds and that there must be room to pass between the hatch coamings and any obstructions where the ladder leaves the deck. He also claimed the obstruction should have been cushioned and lighted. Liability was denied.

Giving judgment his Lordship observed that the space allowed for exit was little more than one foot. He had heard the evidence of the men using it and he was satisfied there had been a breach of Regulation 11. But the question of damages raised an interesting point. Before this particular accident the plaintiff had a condition of the neck which made him especially susceptible to injury. After the accident he had continued working, though in some pain, for about a year, then there was a second incident which brought on acute pain. After reviewing the medical evidence his Lordship said that he could not accept that the effect of the first accident had disappeared before the second, which was trivial, took place. He awarded the plaintiff £2,500 damages.

It seems hard that an employer should be called upon to pay heavy damages in respect of a relatively trival accident which might have had no serious ill effects if the latent weakness had not been triggered off by a second and even more minor accident. But so far as the pre-accident weakness is concerned it is clear that a wrong doer must take his victim as he finds him.

It is perhaps true that both Regulation 11 and Regulation 50 are easily overlooked, because they deal with matters where the dangers are not obvious especially, in the case of the second, if the height involved is small. Failure to take the quite simple precautions required may result in heavy damages, however, particularly as the men concerned often take even less care for their own safety over such matters, than they usually do in the course of their work.

Book Reviews

Decay of Timber and its Prevention, 2nd Edition, by K. St. G. Cartwright and W. P. K. Findlay. (London: H.M.S.O., 1958.) 9½-in. x 6-in., 332+xv pp. 27/6d.

This book is the result of work carried out at the Forest Products Research Laboratory of the Department of Scientific and Industrial Research. Since the first edition was published in 1946 new information has become available, and the new edition has been completely revised and brought up-to-date.

Causes of decay in timber are considered and the principal wood-rotting fungi described. Conditions under which these fungi flourish in standing and felled timber and in timber buildings and structures are explained, and measures for prevention of such damage are suggested. Methods for seasoning, storage and preservation are given, the prevention of decay in plywood in wooden boats receiving particular attention. Chapters are also devoted to the durability of timbers, and to staining and discoloration and its prevention.

Each chapter concludes with a comprehensive bibliography and the book is well illustrated, with ten figures and fifty-seven plates.

Hydraulic Research in the United States, 1959, edited by Helen K. Middleton, National Bureau of Standards Miscellaneous Publication 227, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., U.S.A., 188-pp. Price $1.25, postage extra.

This publication, the latest in a series of annual publications begun in 1951, contains reports on hydraulic research conducted within the past year in the United States and Canada. It serves as a guide in the co-ordination and planning of hydraulics research, thus avoiding duplication of research in the field. The information was compiled from reports by various hydraulic and hydrologic laboratories in both countries and covers the nature of the work, a brief description of the progress, present status and results, and any publications.

Each report bears an identifying number which it carries from issue to issue, as long as the project is active. In this way, its complete history can be traced from inception to conclusion. Further information on the projects can be obtained by writing directly to the organisation carrying on the project. For this purpose, full addresses of all co-operating laboratories are given.

Fumigation with Methyl Bromide under Gas-Proof Sheets. Pest Infestation Research Bulletin No. 1 (Second Edition). Published by the Department of Scientific and Industrial Research and obtainable from H.M. Stationery Office, London, Price 4s. 6d. net.

Since the first publication of this Bulletin four years ago, the method of fumigation with methyl bromide of stacks of commodities under gas-proof sheets has been increasingly practised in many parts of the world. Much remains to be learnt about its use in differing circumstances, but it has been shown to have a wide applicability and is of particular value in countries where facilities for other methods of fumigation are very limited or non-existent. This 50 pp. booklet aims to provide the information which has so far been accumulated and to indicate ways in which the effectiveness of the treatment can be assessed so that any who adopt the method will be better able to adapt and improve it to suit local conditions.

Some of the advice offered in the first edition was supported only by slender experience and it was hoped that the wider use of the method would be accompanied by careful scientific assessment of the requirements for maximum effectiveness under the conditions of different countries. The measurement of gas concentration as well as thorough biological observation as described in the latter part of this bulletin is usually necessary for proper assessment. Only a few instances of such investigations have been reported however and, without these, it is unwise to place much reliance upon general impressions of the overall effectiveness of the fumigations or of the importance of adhering to or modifying particular details of procedure.

On the whole there has appeared to be little reason to modify the main recommendations on fumigating procedures in so far as they apply to whole wheat, maize, ground nuts and like commodities. A new section has been added describing current procedures in Great Britain for fumigating stacks of bagged flour using a heated vaporizer, and additional information is included on the effect of methyl bromide upon flour and upon the germinative power of seeds.

The need to fit the fumigation procedure into a comprehensive programme of control which ensures that the fumigated stocks are not reinfested is also discussed, and the use of thermal conductivity instruments to measure the concentrations of the gas at selected points within the stack is described.

Publications Received

Freight Services to and from Northern Ireland

The extent of the freight and passenger services serving the North Channel and the Irish Sea is dealt with in the second edition of "Freight Services to and from Northern Ireland" which was published early this month by the Northern Ireland Development Council in association with the Northern Ireland Ministry of Commerce.

The brochure briefly describes the traditional general cargo services and the freight facilities available on the fast passenger ships which operate from Belfast, Larne and Londonderry to Glasgow, Heysham, Liverpool and Stranraer and gives details of the Container services. The road transport companies which use drive-on/drive-off ferry ships from Larne and Belfast are listed and details are also given of the improved facilities available at the Ulster Ports; at Belfast alone the new installations have already cost £4 million and schemes at present in hand will cost a further £2 million.

Tables in the brochure set out the services from each port; there is a separate table for the services from Belfast to foreign ports. These tables are clearly linked with an alphabetical directory of carriers. A separate section deals with the air freight services which are shortly to be extended to Cardiff and Bristol. A table of road distances from Northern Ireland ports and a road and rail map in colour should provide shipping departments with useful information.

Copies are obtainable, free of charge, from the Northern Ireland Development Council, 13 Lower Regent Street, London.

Isocrete Lightweight Cellular Concrete

Cellular lightweight concrete has developed into an important new building material in Britain over the past few years. Quite spectacular advances have been made in this field by the Isocrete Company Limited with their material " Isocrete." Now, for the first time, a comprehensive booklet has been published to explain in technical detail its properties, range of applications and the methods in which it can be used to gain maximum advantage.

This publication, called " Isocrete-Technical Data," is the culmination of several years' study in the laboratory and on site. It is probably the most comprehensive reference book on lightweight concrete available at the present time; it not only deals directly with lightweight cellular concrete but also gives details of a wide range of studies and methods which play an incidental role in the application of lightweight concrete.

Copies of the booklet can be obtained from Isocrete Company Ltd., 124 Victoria Street, London, S.W.1.

Manufacturers' Announcements

Conveyor Belt Installations in Sicily

The installation of two conveyor belt systems, one at the S.I.N.C.A.T. fertilizer plant at Priola near Syracuse, and the other at the Cementerie Di Augusta at Augusta, has recently been completed in Sicily.

At Priola the main rayon reinforced belt 31½-in. x 5-ply at 1,865-ft. centres, has a total length of 3,798-ft. in three rolls. It is designed to carry either loose or bagged artificial fertilizer, and is supported by three 20° troughing idlers with a roll diameter of 4¼-in. at centres of 29½-in., and side guide idlers every 100-ft. Return idlers, consisting of five rubber discs about 5-in. in diameter, are mounted on a horizontal shaft.

The drive is a gear driven crowned drum single head drive, the drum diameter being 1 m. and the width 36-in. The take-up consists of a return drum in slides weighted by counterweight box. The total amount of take-up is 775 cms. The counterweight is 2,000 kilos. The whole installation is driven through four vee belts by a 37 h.p. motor.

The fertilizer is conveyed from the processing plant just off shore, to a second conveyor from which it is delivered by chute into the holds of ships lying alongside the jetty.

The two-way covered installation at Augusta.

At the cement works at Augusta, there is a double installation, one belt running above the other, the bottom belt with 619 m. (2,030-ft.) centres being used to carry bags of cement to waiting vessels, and the top belt of 639 m. (2,100-ft.) centres for transporting raw material from the ships into the cement processing plant. The belting for both was 26-in. x 6-ply 32 oz.

Both the carrying and return side of the bottom belt have flat 29½-in. wide rollers. Carrying idlers are at 31-in. centres and return idlers at 9-ft. centres. The drive for this belt is at the sea end of the installation and consists of a 40-in. dia. single head lagged drum, the belt gear being driven from a 31 h.p. motor. A 19-in. diameter snub roller is so placed as to increase belt contact on the drive drum. The counterweight drum has a diameter of 800 mm. and is 29-in. wide. The take-up consists of a moveable carriage with a travel of 6½ m. The counterweight used is 120 kilos.

The top belt has a similar drum diameter and is carried in three 30° roll idlers. The counterweight consists of the belt hanging in a vertical frame.

A subsidiary conveying system, serving the main conveyor with sacks of cement from a bagging machine, is fitted with 26-in. x 4-ply 32 oz. belts.

Both systems were installed by the Goodyear Tyre and Rubber Company Ltd. of Wolverhampton.

New Truck Crane

Thomas Smith and Sons (Rodley) Ltd., Rodley, Leeds, have recently introduced the M.E.I. Truck Crane to meet the U.S.A. 5-ton (2,000 lbs.) lifting capacity ratings. The maximum lifting capacity of this crane on British ratings is 22½ tons (50,000 lbs.) at 10-ft. radius when working with the 30-ft. basic boom and 4.7 tons at 25-ft. radius with the maximum boom length of 100-ft. It is mounted on a six-wheeled "Foden" unit with a heavy-duty chassis frame, which has an overall width of 8-ft. to permit unrestricted travel on British public highways.

The crane carrier incorporates outriggers, designed to eliminate deflection, with screw jacks which can be extended to 13-ft. centres to provide adequate stability for heavy loads and high-lift work. It is powered by a "Gardner" 5LW engine, developing 94 b.h.p. at 1,700 r.p.m. as standard. A 6LW engine can be fitted if preferred. Transmission is by single-plate clutch and a five-speed or eight-speed gearbox. The brakes are air pressure operated and the electrical system is 24 volts for both starting and lighting. The rear bogie of the chassis is mounted on substantial rocking beams with a third rocking beam to compensate for individual axle movement. Both axles of the rear bogie are driven and the road wheels are fitted with metallic corded tyres. The cab is specially designed with a central trough to allow the crane boom to be carried in a forward position.

The revolving superstructure is fitted with the winch mechanism control gear and power unit and rotates on a large diameter live ring with 20 rollers, the tilting forces of the turret being taken by 3 fully-adjustable hook rollers. The winch machinery and controls are fully covered and access to them is provided by removable panels.

The 30-ft. basic crane boom can be extended by 10-ft. and 20-ft. pin-jointed sections to a maximum length of 100-ft., and the head is of semi-hammer-head construction. The boom suspension ropes are reeved on to a bridle which permits lengthening sections to be added to the rope the same time as the boom is lengthened.

A tubular constructed fly jib is also available, the basic length being 20-ft. jointed in the centre for insertion of lengthening sections, and the machine can be converted with additional equipment for duty as a 2-line grabbing crane, piledriver, face shovel, back hoe and dragline.

New Section Dredger for Port Talbot

British Transport Docks have ordered a new, twin-screw, diesel-electric suction dredger for service at Port Talbot. The new vessel will supplement the existing dredging fleet and will help to provide and maintain an approach channel deeper than that at present available.

The principal characteristics of the new dredger, which is to be constructed by Richard Dunston Ltd., of Thorne, near Doncaster, will be: Length B.P. 185-ft.; Breadth, moulded 36-ft.; Depth, moulded 16-ft.; Hopper capacity 1,000 cu. yards; Speed 10 knots; Suction pipes 2.

Manufacturers' Announcements—continued

Sydney's New Opera House

The Sydney Opera House is being constructed within a stone's throw of the famous Sydney Harbour, Australia, and demolition gangs have completed the task of clearing the site in preparation for laying the foundations. This involved the complete demolition of Fort Macquarie, formerly used as a storage depot for the electric trams which, until about a year ago, ran in the Sydney streets.

Compressed air was used extensively in the demolition and also in the preparatory foundation work. In these operations, "Broomwade" pneumatic equipment played an important part.

One of the two "Broomwade" air compressors at work at Benelong Point, Sydney Harbour.

Two "Whirlwind Uniflo" portable, rotary, two-stage air compressors, each delivering 120 c.f.m. at 100 p.s.i. were used to supply the air for the type RB 77OB, heavy duty breakers for pile driving and breaking up the concrete and heavy shale deposits.

Considerable trench excavation was necessary and, in this connection the "Broomwade" type CD5 clay spades proved their worth as did the type TP3 air-operated sump pumps employed.

When the actual erection work commences, a concrete pumping machine will be used to transport the large amounts of concrete that will be used in the construction of the Opera House. For this purpose, two "Broomwade" portable rotary air compressors will be employed, a type WR 175 delivering 175 c.f.m. and a type WR 250 delivering 250 c.f.m. at 100 p.s.i.

CLASSIFIED ADVERTISEMENTS

Rates 4s. per line (minimum 8s.); Box Number 2s. extra; Rate for single column inch is £2 per inch. Prepayment of classified advertisements is requested. Orders should be sent to Advertisement Department, "The Dock and Harbour Authority," 19, Harcourt Street, London, W.1. Telephone: PAD 0077.

FOR HIRE—Electric and Diesel Forklift Trucks for long- or short-term hire. Fork Lift Trucks for Hire Limited, 2 Abbots Road, London, E.6. GRAngewood 7101.

FOR SALE

ABERDEEN HARBOUR COMMISSIONERS

THE COMMISSIONERS offer for sale two Diesel-Electric Mobile Tower Cranes which are surplus to their requirements.
The cranes are capable of handling 2 tons at 50-ft. radius, 3 tons at 40-ft. radius and 4 tons at 30-ft. radius on single rope, hook or 2-rope grab at hoist speeds up to 240-ft./minute, and 8 tons at 15-ft. with double block. The cranes are extremely versatile for cargo work and incorporate provision for straight line transporting as well as slewing and derricking.
Further particulars can be obtained from the undersigned with whom tenders should be lodged in a sealed envelope endorsed "Diesel-Electric Cranes," not later than 22nd February, 1960.

JOHN ANDERSON,
Harbour Engineer.

15 Regent Quay,
Aberdeen.

STEEL-FRAMED BUILDINGS for sale; 8-ft. to 400-ft. clear width, as Workshop, Storage, Hangar Buildings, etc. Please write details of requirements. Bellman Hangars Ltd., Hobart House, Grosvenor Place, London, S.W.1.

TENDERS

AUCKLAND HARBOUR BOARD

Tenders are invited from experienced British and Continental manufacturers for the supply and delivery of a 100-TON SELF-PROPELLED DIESEL-ELECTRIC LEVEL-LUFFING FLOATING CRANE.
The latest date for submission of Tenders is Tuesday, 3rd May 1960 and full documents may be obtained against a deposit of £5 from the London Agents to the Board, William Coward & Co. Ltd., 3 St. James's Square, London, S.W.1.

APPOINTMENTS VACANT

ENGINEERING INSPECTORS: MINISTRY OF HOUSING AND LOCAL GOVERNMENT. Four pensionable posts in London for men and women at least 35 on 1.1.60. Duties involve investigation of technical and economic merits of engineering proposals submitted to the Ministry. Qualifications: A.M.I.C.E., and wide experience of civil engineering work. Special knowledge and experience in one or more of the following fields essential: sewerage and sewage disposal, sea defence, water supply. Honours degree in Engineering an advantage. Starting salary (men, London) from £1,600 at 35 to £1,890 (or higher if exceptionally well qualified or experienced) at 40 or over. Scale maximum £2,450 (London). Promotion prospects. Write Civil Service Commission, 17 North Audley Street, London, W.1 for application form quoting S5085/60/13. Closing date 16th February 1960.

CIVIL ENGINEERS required for HYDRAULICS LABORATORY. Must have university degree in civil engineering with hydraulics as one subject, or equivalent qualification, and preferably have some post-graduate experience in hydraulics research and practical experience in model investigations. Duties will be concerned with hydrographic surveys, and the construction and operation of models for investigations of river and harbour works, hydroelectric schemes and coast protection. Good prospects for advancement. Write, stating age, qualifications and experience, to GEORGE WIMPEY & CO., LIMITED, Central Laboratory, Springfield Road, Hayes, Middlesex.

ADMINISTRATION OF TRIPOLITANIA requires a PORT ENGINEER for work in Tripoli Port, Libya, North Africa.
Applicants should be chartered civil engineers with experience of the maintenance of dock and harbour installations.
The commencing salary will be £1,750 per annum with 8% deductable for income tax. Accommodation can be provided in the port.
The contract will be for a period of two years in the first instance. Leave on the basis of 3 days per month will be granted after the completion of each two years' service.
Free first-class passages for officer and family will be granted.
Application should be sent to the Port Manager, Tripoli Port, Libya.

THE MANCHESTER SHIP CANAL COMPANY

The Manchester Ship Canal Company invite applications for the appointment of Assistant Civil Engineers and Design Engineers on the established staff of the Chief Engineer. Scale of salaries £805 at age 25, rising by annual increments to £1,250 at 38 with prospects of promotion to higher grades at salaries up to £1,720.
Candidates should be Corporate Members of the Institution of Civil Engineers or hold equivalent qualifications, and should have experience in design, specifications, construction and maintenance of Civil Engineering works. Harbour and dock experience is preferable but not essential. Successful applicants will require to become members of the Company's Contributory Superannuation Scheme.
Applications, stating age, qualifications and experience, should be addressed to the Chief Engineer, The Manchester Ship Canal Company, Ship Canal House, King Street, Manchester 2, not later than 13th February 1960.

YOUNG GRADUATE CIVIL ENGINEER REQUIRED by old-established firm dredging contractors. Previous experience not essential. Employment on permanent basis with full staff benefits for right man. Write Box No. 226, "The Dock and Harbour Authority", 19 Harcourt Street, London. W.1.

SHOT BLASTING in-situ by the 'on-site' experts. Organic and Inorganic Coatings applied. Anything, anywhere at competitive rates. Darnall Shotblasting Co., Ltd., Doctor Lane, Sheffield, 9. Telephone 42896.

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